

# Human Environment Regional Observatory (HERO) 2024 Stakeholder Presentation

Assessment of Tree Health and Resident Perspectives in Holyoke and Chelsea

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Jack Keane, Mara Litten,  
Kalon Shepard



# Meet the 2024 HERO Team!



From Left to right: Kalon Shepard, Quinn Chang Martin, Espi Garschina-Bobrow, Jack Keane, Mara Litten, Aria Cranford, Juju Kaiser, Aidan Caron, Adlai Nelson, Tanner Honnef, Nicholas Geron

## **Undergraduate Fellows**

Quinn Chang Martin, Aria Cranford, Espi Garschina-Bobrow, Juju Kaiser, Jack Keane, Mara Litten, Kalon Shepard

## **Team Managers and Graduate Mentors**

Jason Andrews, Aidan Caron, Nicholas Geron, Tanner Honnef, Adlai Nelson

## **Directors**

Dr. John Rogan and Dr. Deborah Martin

<https://www.clarku.edu/departments/hero-program/>



# GREENING THE GATEWAY CITIES

MA Urban Canopy Project

Goals include increasing canopy cover by 5% in high priority neighborhoods in Gateway Cities throughout Massachusetts. Tree canopy has numerous energy and environmental benefits such as lowering high temperatures and wind speeds.

“Gateway City” = population ranging from 30,000-250,000, with median household income and educational attainment lower than the Massachusetts average. Plantings are happening in 23 out of 26 Gateway Cities!



An American Linden (*Tilia americana*), surveyed in 2017 (left) and re surveyed in 2024 by Kalon (right)



Natalie, an urban forester in Holyoke planting a European Hornbeam (*Carpinus betulus*)

GGCP planting starts in 2014 in three pilot cities; Chelsea, Fall River, and Holyoke.

From 2017-2019 HEROs also surveyed trees in Chicopee, Leominster, and Pittsfield.

40,000th tree planted in Chicopee in April of 2024

2024 HEROs return to Holyoke and Chelsea

HERO partners with GGCP for the first time in 2017, comparing tree health and the contributions of residents and stakeholders across three cities; Holyoke, Chelsea and Revere.

\$1.3 million federal funds to the GGCP Spring 2023

# Presentation Outline

HERO 2024  
Research  
Objectives  
and Study  
Areas

Biophysical  
Field  
Methods  
and Data  
Collection

Tree  
Assessments  
and Statistics

Species  
and  
Growth  
Analysis

Interview  
Analysis  
and  
Takeaways

Conclusions



*HERO team having lunch in O'Malley State Park in Chelsea*



*These "H" and "C" icons represent which city is being referred to and which data set is being used in figures and slides*



# HERO 2024 Study Objectives

## Biophysical

Measure the growth and survivorship of trees planted by the DCR's Greening the Gateway Cities Program in Holyoke, MA and Chelsea, MA.

What is the current status of tree health and structure and what factors have the greatest impact on tree growth and survivorship?

How does the tree health and structure compare to the 2017 HERO tree survey?

## Social

Interview community members in Chelsea and Holyoke about their perceptions around tree planting and stewardship.

How do residents perceive the role of trees on their property and in their neighborhood?

How does the DCR collaborate with community partners during tree planting initiatives?





1,500 Trees  
Surveyed

# Holyoke

**Population:** 37,628 - 1,806 per sq. mile

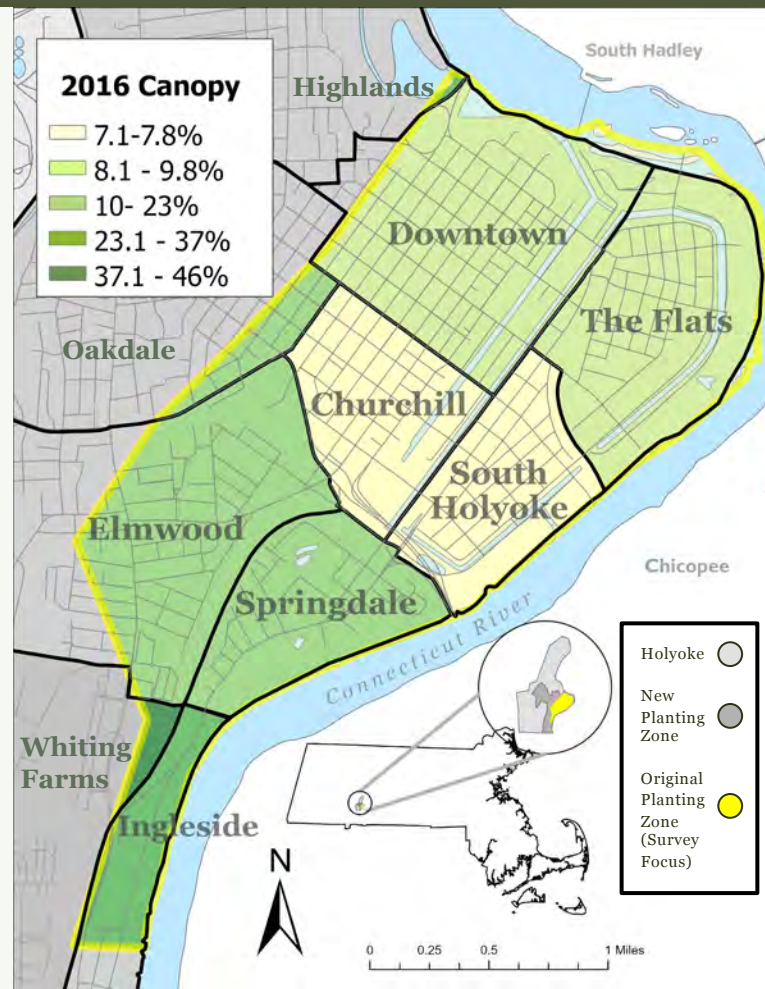
**Median Household Income:** \$49,007, MA: \$95,505

**Education:** 22.2% of persons aged 25+ have obtained a Bachelor's degree or higher , MA: 45.9% Bachelor's degree or higher

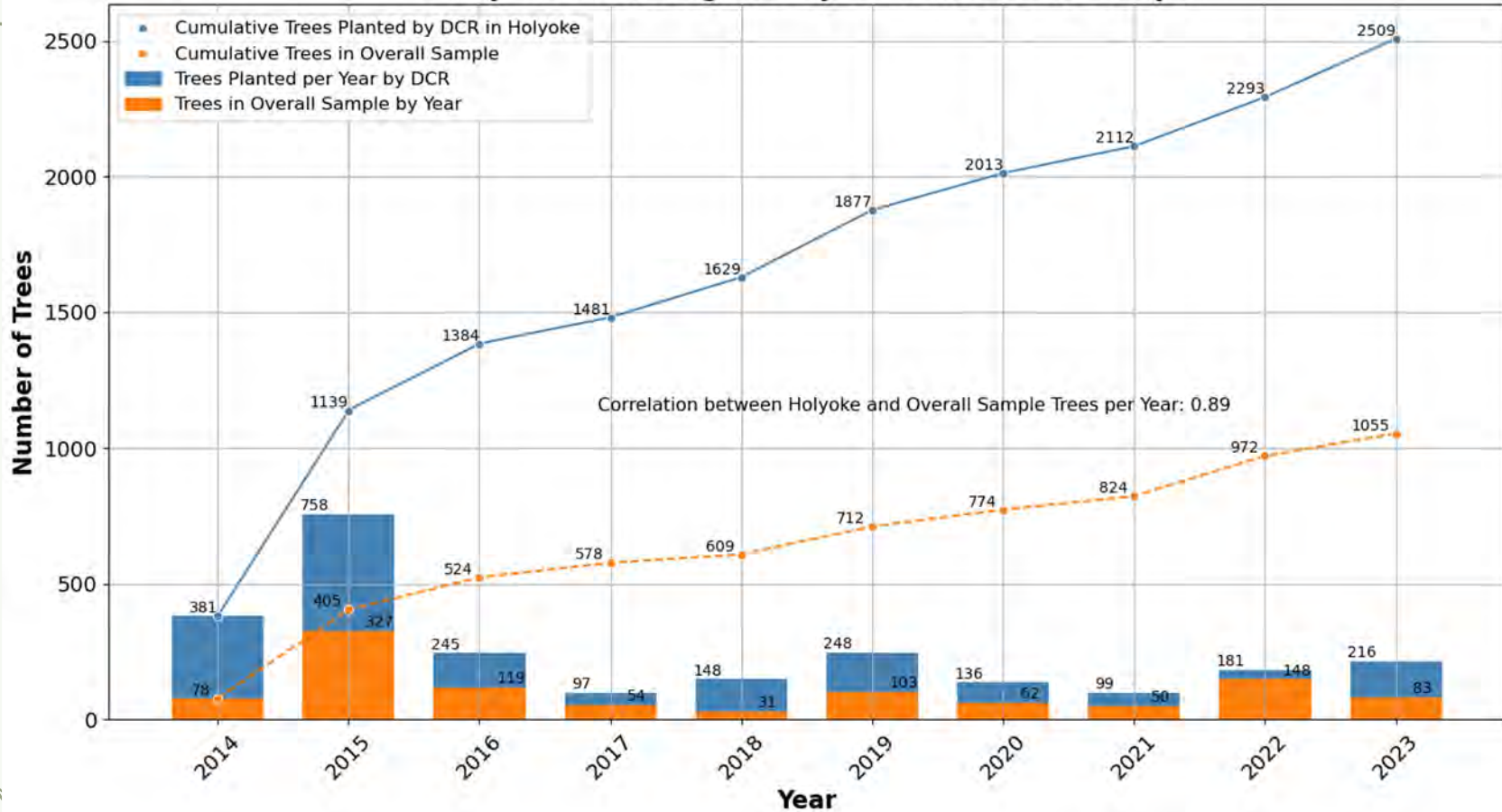
Racial Demographics	Holyoke	Massachusetts
White	67.5%	79%
Hispanic or Latino	51.7%	13.5%
Black or African American	4.6%	9.6%
Asian	0.8%	7.9%

53.7% canopy cover  
for all of Holyoke,  
14.2% for our Study  
Area

42.6%  
Spanish  
speaking



## Yearly Tree Planting in Holyoke and Overall Sample





1,509 Trees  
Surveyed

# Chelsea

**Population:** 38,319 - 17,974 per sq. mile

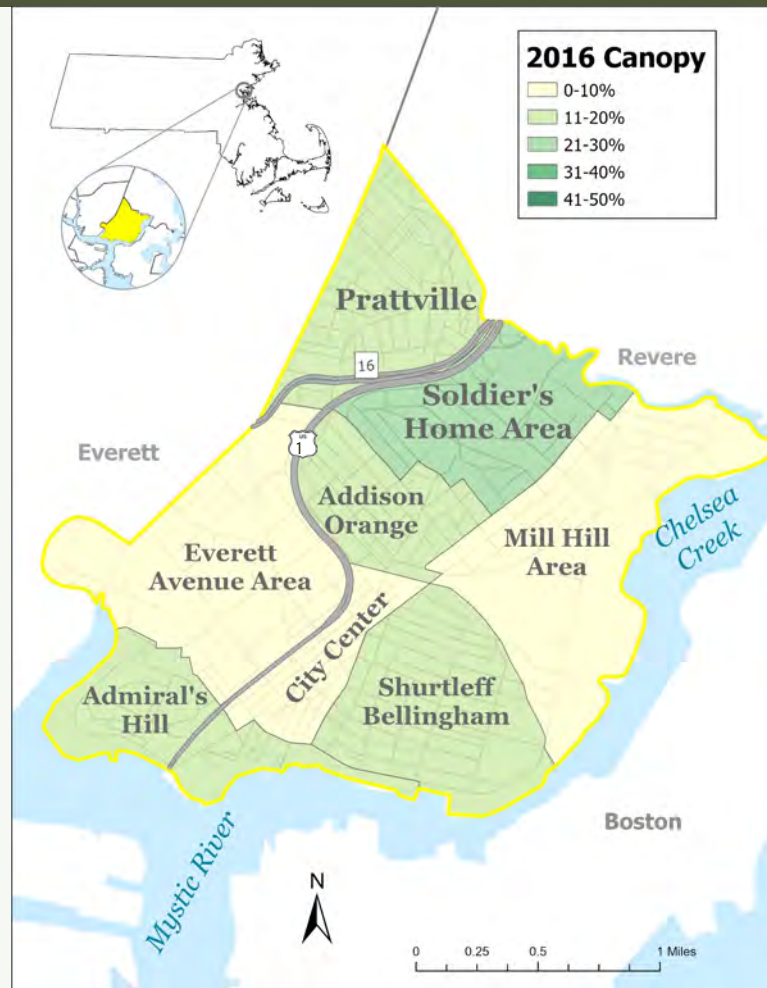
**Median Household Income:** \$71,051, MA: \$95,505

**Education:** 21.6% of persons aged 25+ have obtained a Bachelor's degree or higher , MA: 45.9% *Bachelor's degree or higher*

Racial Demographics	Chelsea	<i>Massachusetts</i>
White	33.9%	79%
Hispanic or Latino	67.4%	13.5%
Black or African American	6.2%	9.6%
Asian	2.9%	7.9%

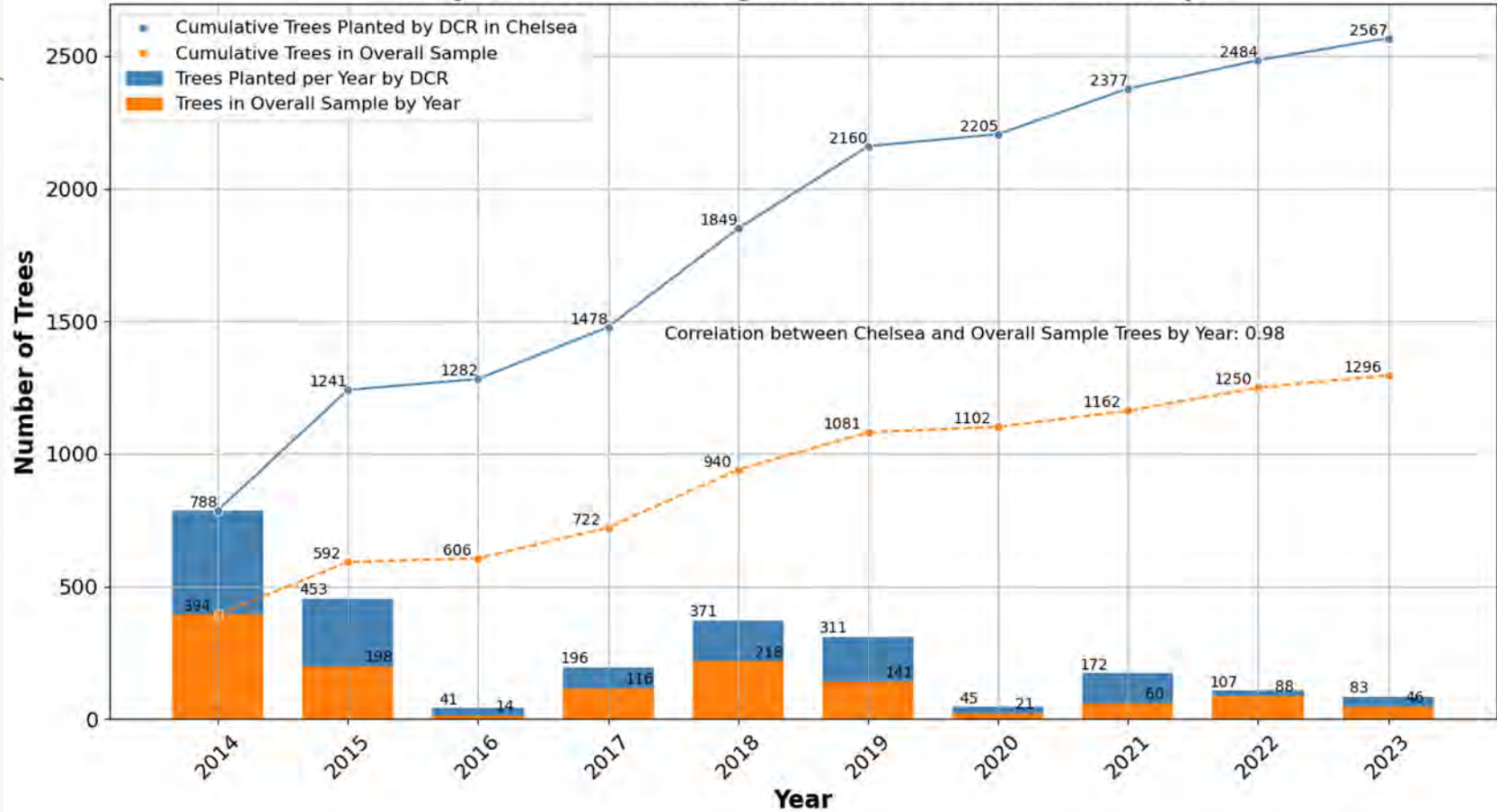
10.9%  
canopy  
cover in  
2016

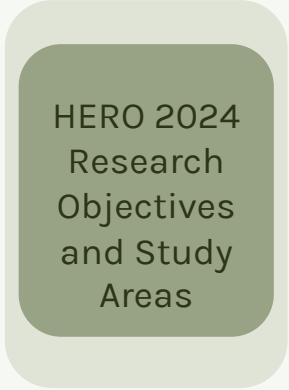

60.3%  
Spanish  
speaking





## Yearly DCR Tree Planting in Chelsea and Overall Sample





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# Biophysical Field Measurements

## Tree photos:

Capturing images of measured trees with its associated ID number



Jack (left) and Adlai (right) measuring the crown width of a Red Oak (*Quercus rubra*). Methods from (Roman et al., 2020)



## Diameter at Breast Height (DBH):

Measured in inches, at 54 inches, or the closest unobstructed point with a diameter tape



## Crown Width:

Measured in feet using a standard measuring tape



## Tree Height:

Measured in feet using the Nikon Forestry Pro II rangefinder/ hypsometer



Juju skillfully getting the height of a tree in an Industrial "Other Maintained" site.

# Data Collection and Input



Collect Submit

Holyoke DCRHERO2017 war...  
42.204405°N 72.611878°W

TreeID  
101613

SPECIES  
Zelkova serrata

DATEPLANTED  
9/30/14, 8:00PM

ADDRESS

area  
18

Date of survey 2024  
6/7/24, 1:54 PM

Crew\_24  
TH JHK AEC

Mortality 2017  
A

Mortality 2024  
Alive

Collect Submit

Holyoke DCRHERO2017 war...  
42.204405°N 72.611878°W

INS 1

LandUse  
INST - Institutional

SiteType 2017  
SP

Site Type  
SP - sidewalk planting stip

DBH\_in  
1.81

DBH1\_24  
6.7

DBHHeight 2017 ft  
4

DBHHeight 2017 inches  
6

DBH1H\_24  
54

Height that DBH 1 was measured at. Standard is 54 inches.

Collect Submit

Holyoke DCRHERO2017 war...  
42.204405°N 72.611878°W

HEIGHT 2017  
13.5

Height (ft)  
26.5

round to nearest .5 ft

WIDTH 2017  
7.666666667

Width (ft)  
16.25

Round to nearest three inches (but input as decimal ex. 5 ft 0 in = 5.75)

Basal Sprouts  
No

Vigor 2024  
1

Condition 2024  
Good

ArcGIS Field Maps mobile app locating tree ID #101613, a Japanese Zelkova (*Zelkova Serrata*) in Holyoke, MA

*Field Maps shows previous data input where relevant along with the species and precise address. Measurements such as tree height, DBH, and canopy width are recorded.*



# Land Use and Site Type

What is the land around the tree being used for? What kind of space is the planting site?



Commercial, Sidewalk  
Cutout



Institutional, Maintained  
Park



Multi-family Residential,  
Sidewalk Planting Strip



Single Family  
Detached, Front Yard

# Assessing Survivorship



101294

Alive



464

Standing Dead



1172

Stump



1619

Removed



Unknown





# Assessing Vigor – Canopy Fullness

[1] 90% to 100% full



[2] 90% to 75%



[3] 75% to 50%



[4] 50% or less



From left to right, Swamp White Oaks (*Quercus bicolor*) decreasing  
in vigor

Roman, L. A., van Doorn, N. S., McPherson, E. G., Scharenbroch, B. C., Henning, J. G., Östberg, J. P., ... & Vogt, J. (2020). Urban tree monitoring: A field guide. *Gen. Tech. Rep. NRS-194*. Madison, WI: US Department of Agriculture, Forest Service, Northern Research Station. 48 p., 194, 1-48.



# Assessing Tree Condition– Structure and Health



Diseased Leaves



Bark damage



2322

**Good:** Tree is healthy, no damage to bark or leaves



2447

**Fair:** Some damage to bark or leaves that affects health



936

**Poor:** Damage to bark or leaves that significantly impacts health

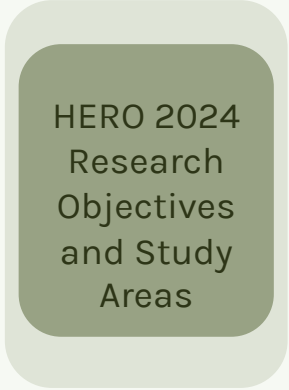



Trunk damage








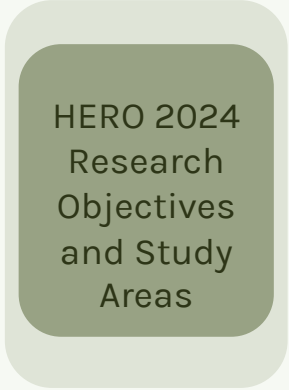
Basal Sprouts





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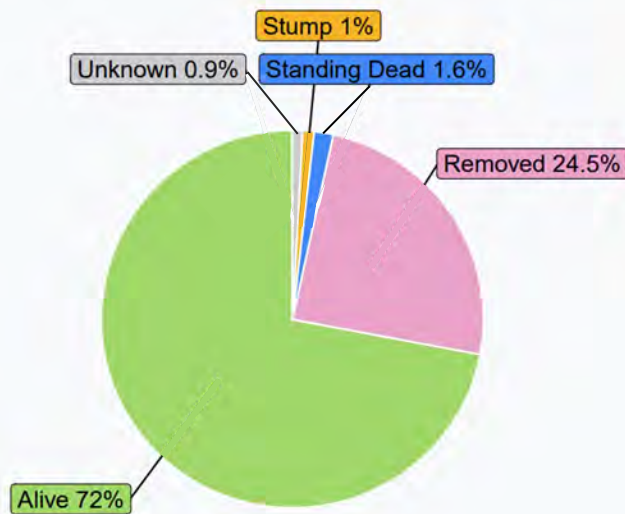
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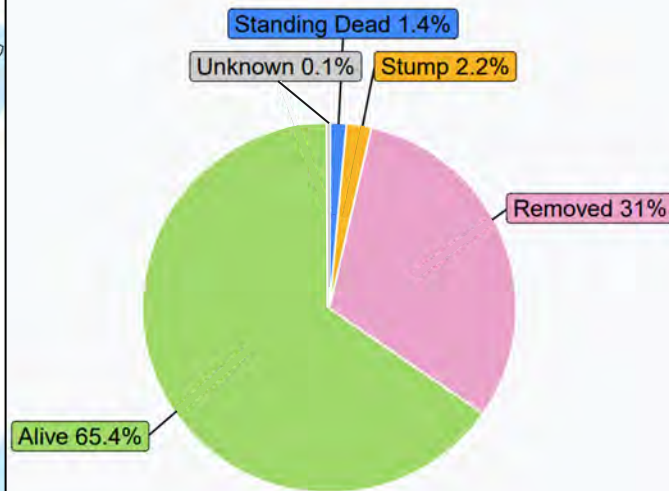
# Holyoke Overall Survivorship



Years Planted	Survivorship
2014-16	59.4%
2017-19	69.1%
2020-23	92.7%



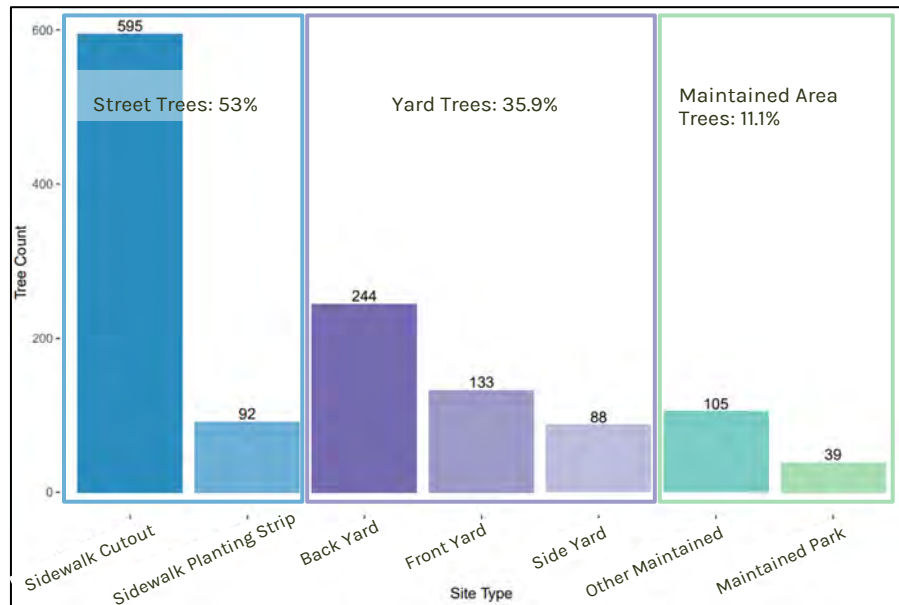
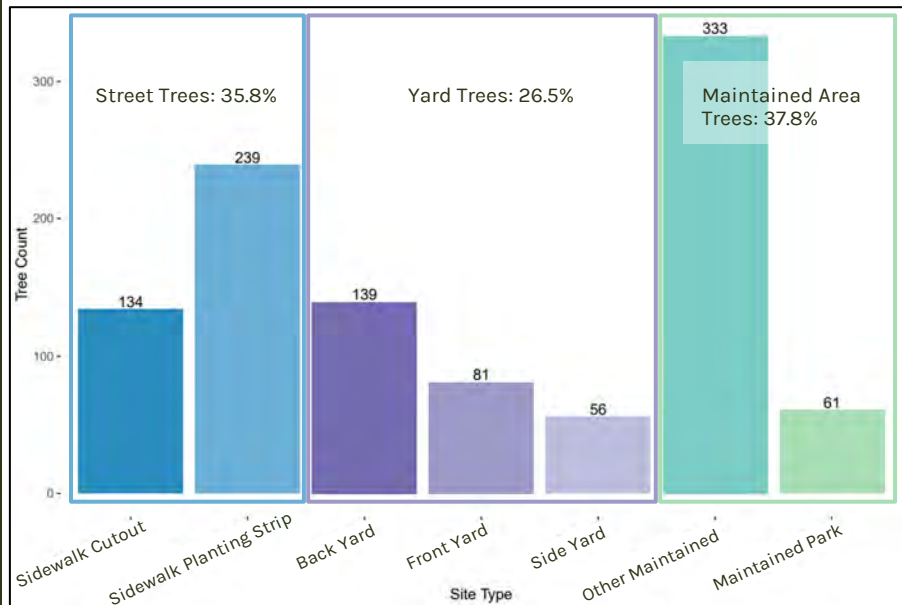
# Chelsea Overall Survivorship



Years Planted	Survivorship
2014-16	56.8%
2017-19	68.8%
2020-23	81.7%

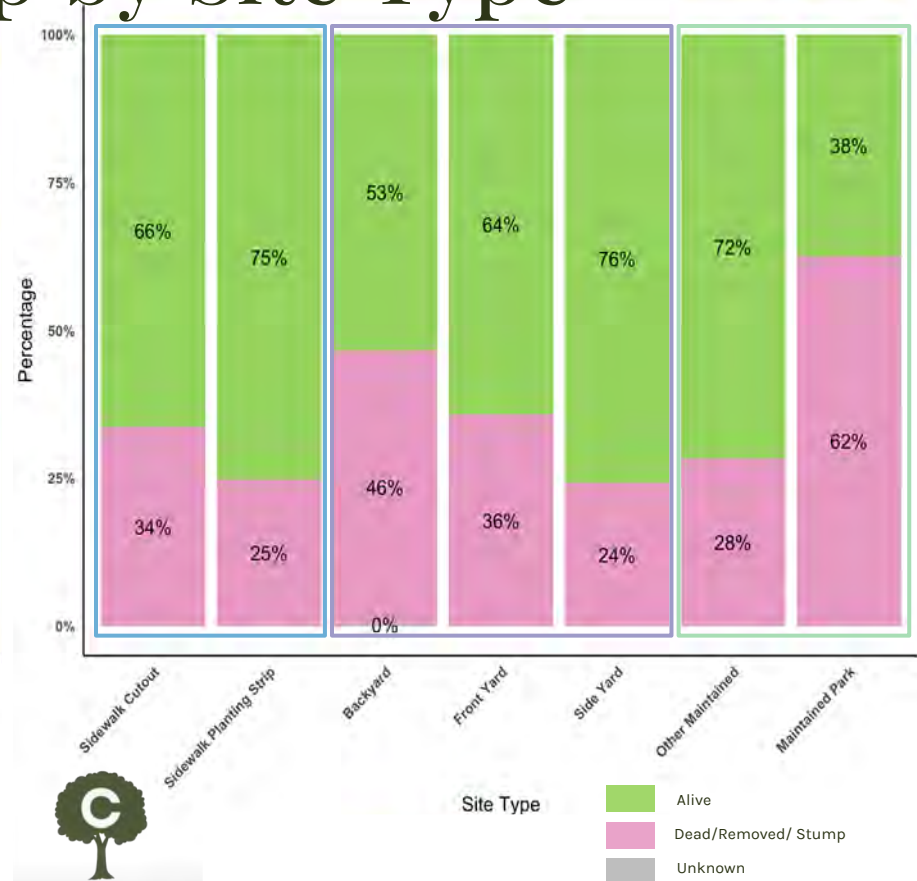
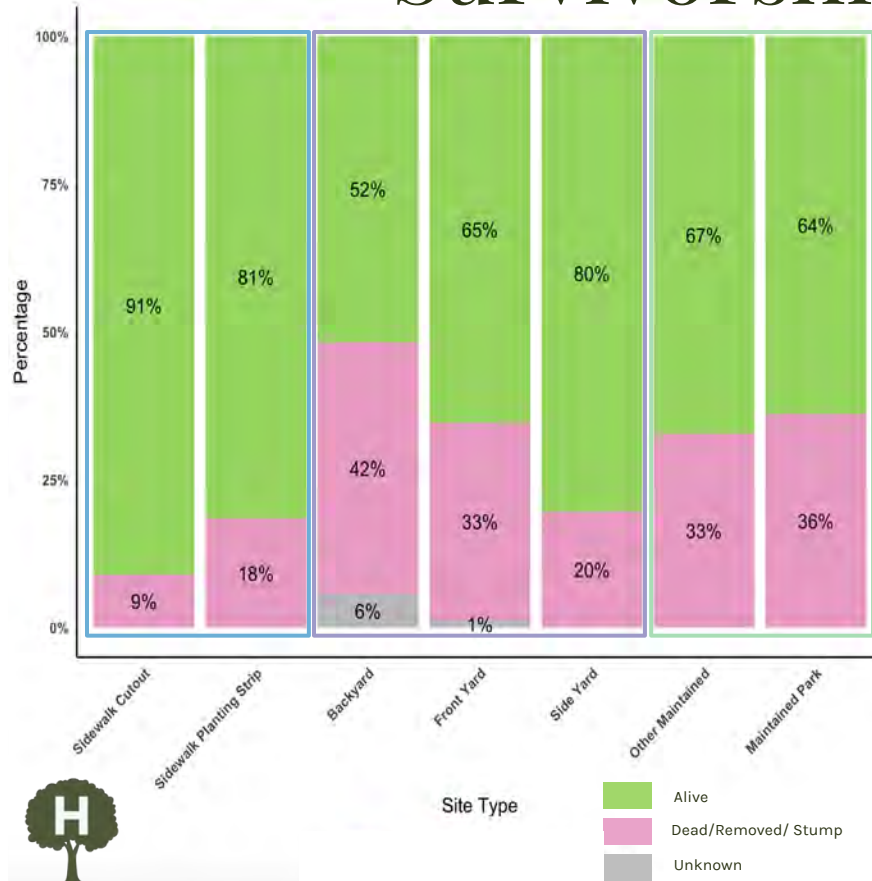
# Tree Count by Site Type

“Other maintained” areas includes lawns on industrial or commercial property, public housing, and religious institutions.



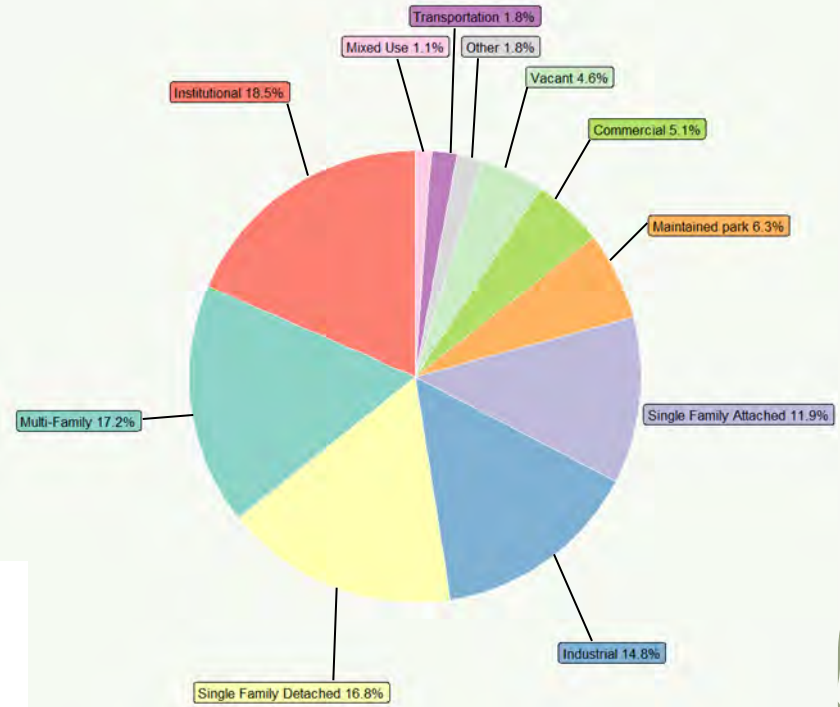
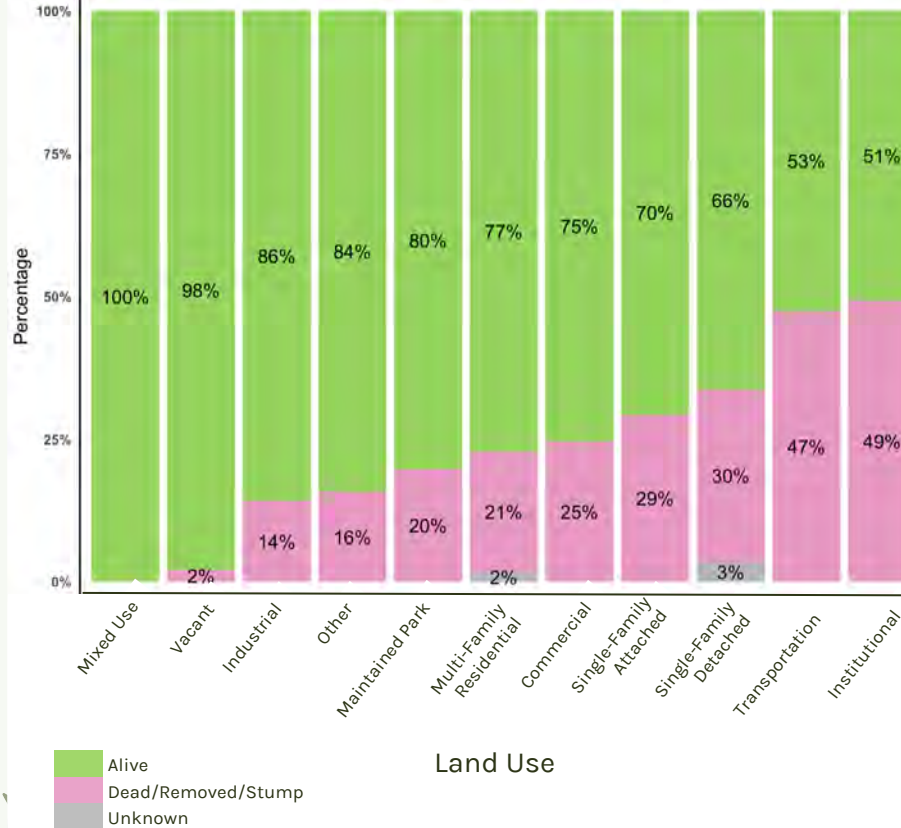


# Survivorship by Site Type





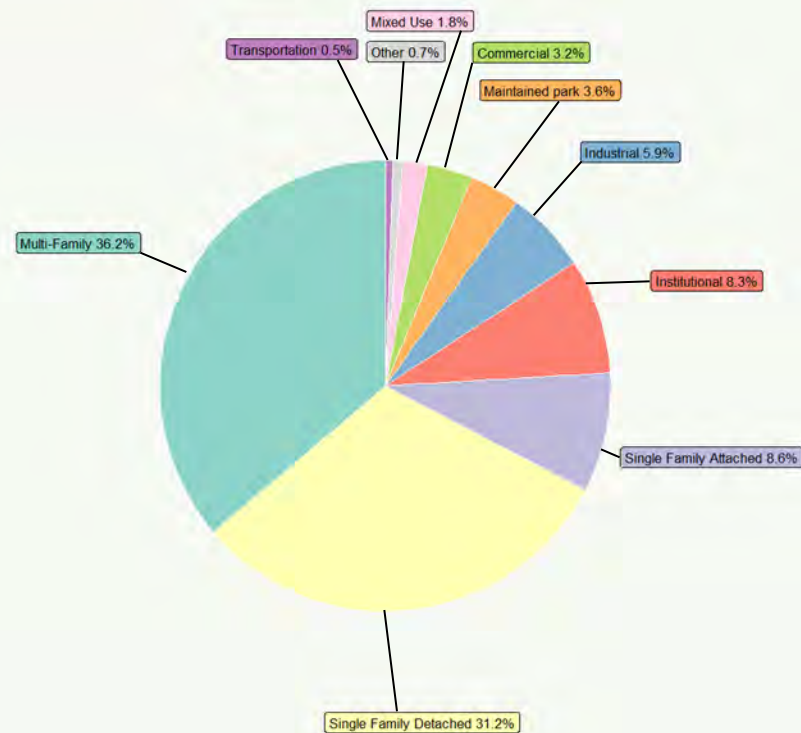
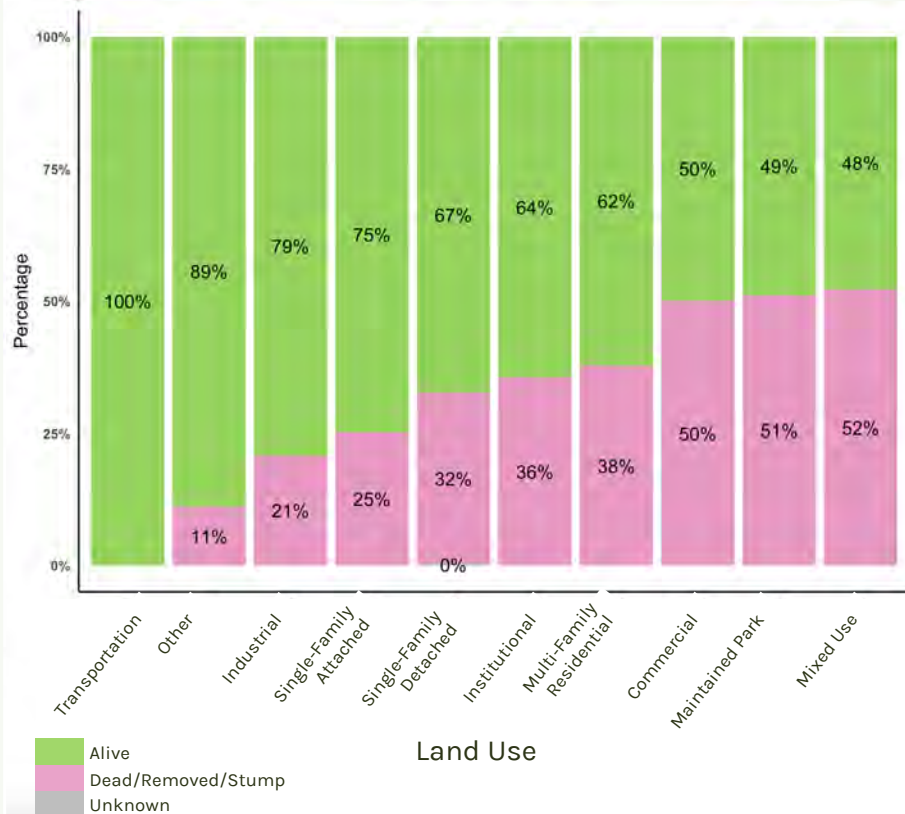
# Survivorship and Count by Land Use



Percent of trees per land use

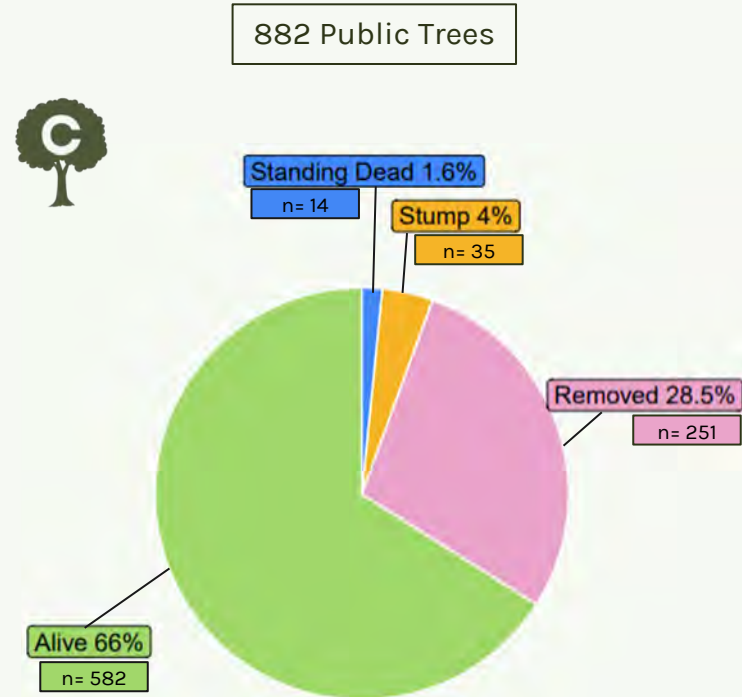
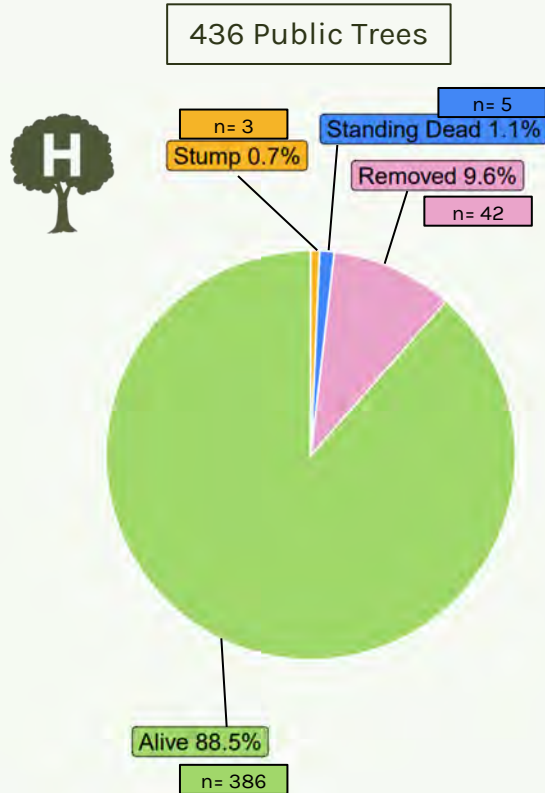


# Survivorship and Count by Land Use



Percent of trees per land use

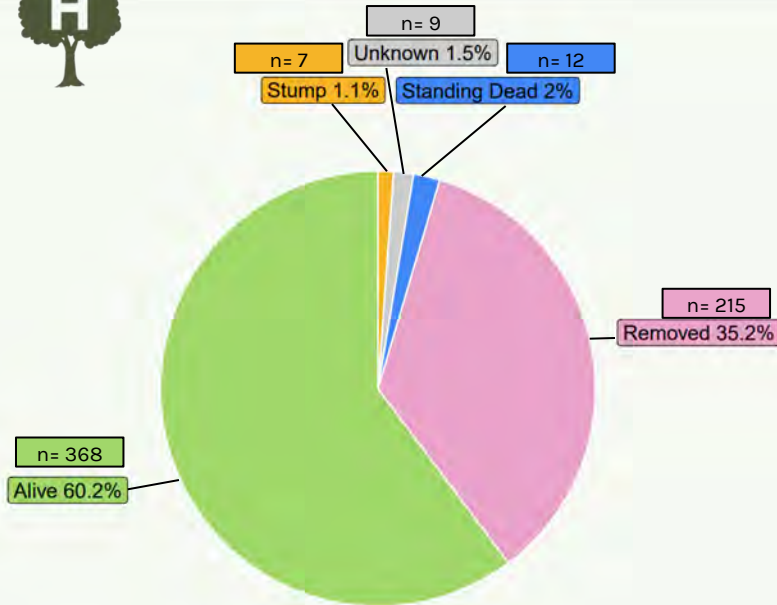
# Survivorship of Public Trees



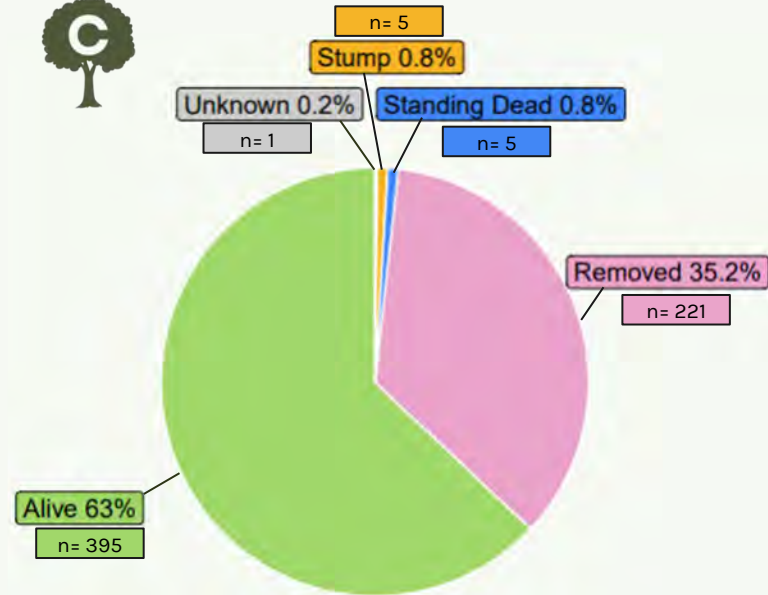


# Survivorship of Private Trees

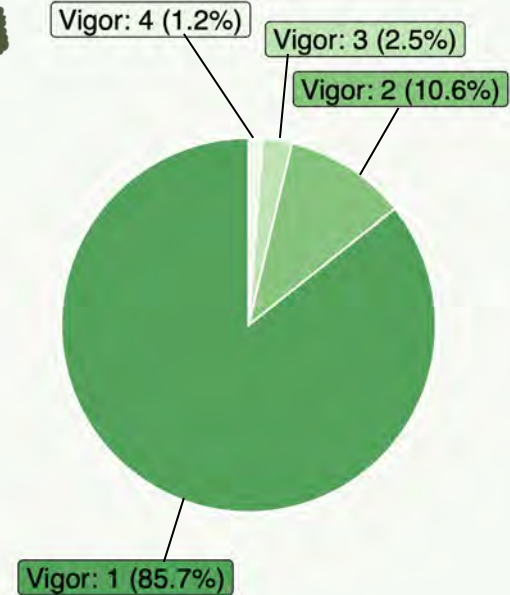
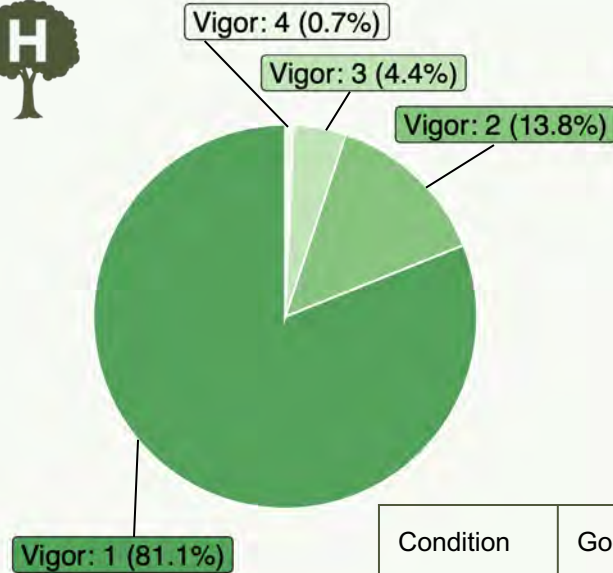
611 Private Trees



627 Private Trees



# Health of Living Trees



Condition	Good	Fair	Poor
Holyoke	83.1%	15.2%	1.8%
Chelsea	81.8%	15.6	2.6%



# 2017 Resurvey



A Tulip Tree (*Liriodendron tulipifera*)  
in Malloy Park, Holyoke, in 2017



HERO Manager Zhiwen Zhu measuring an English Oak  
(*Quercus robur*) in front of the Holyoke Boys and Girls Club in  
2024  
Manager Tanner and Fellow Jack measuring the same  
English Oak in 2017






# Resurvey Statistics

Taking another look at the trees planted between 2014 and 2016.  
Trees surveyed in 2017 and 2024



- **731 Trees surveyed:**

341 Private 

417 Public 

- **Survivorship:**

- 426 alive
- 305 dead, removed, or stump

*\*62 species*



An American Sweetgum (*Liquidambar styraciflua*) in Holyoke being surveyed by former HERO manager Marc (left) and current fellow Kalon (right)

- **385 Trees surveyed:**

60 Private 

325 Public 

- **Survivorship:**

- 224 alive
- 161 dead, removed, or stump

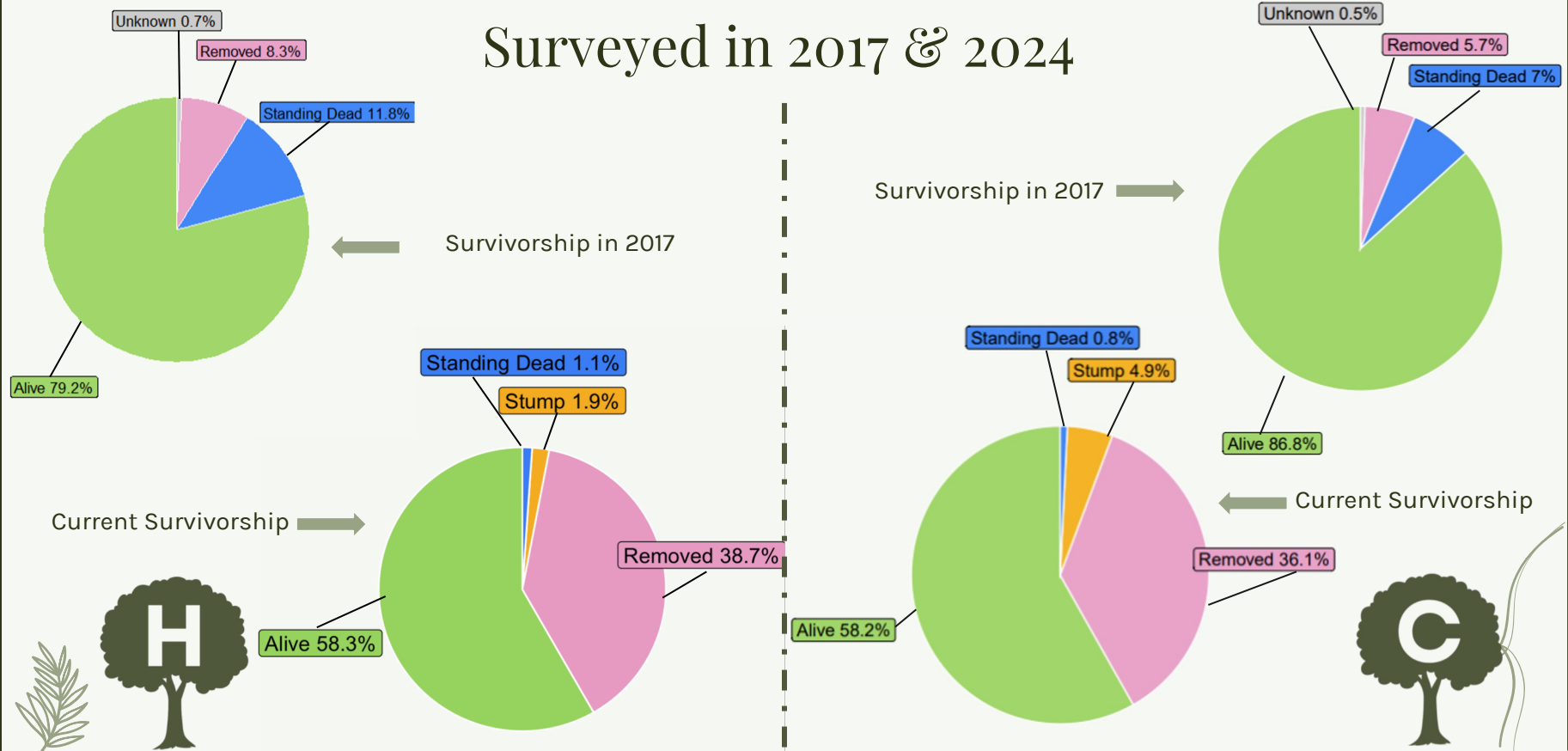
*\*57 species*





# Resurvey Sample Survivorship

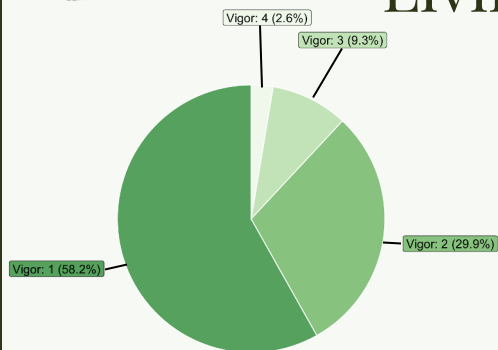
Surveyed in 2017 & 2024





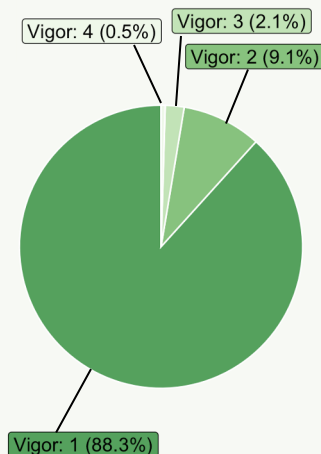
# Resurvey Sample Health

## Living Trees Surveyed in 2017 & 2024



Vigor in 2017

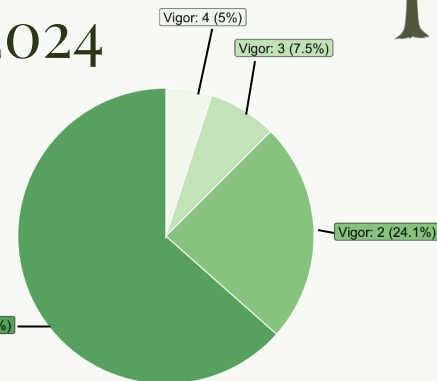
Vigor in 2024



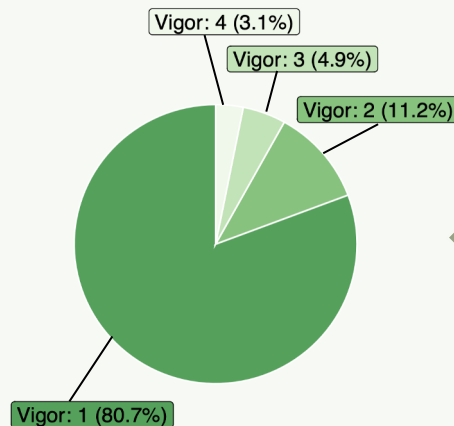
Vigor in 2017



Vigor: 1 (63.4%)



Vigor in 2024



# Summary of Tree Assessment

## Overall

Holyoke has higher survivorship (72%) than Chelsea (65.4%)

Trees planted between 2020 and 2023 have 11% higher survivorship in Holyoke (92.7%) than Chelsea (81.7%)

Public Trees have higher survivorship than private in both cities

## Tree Health

Over 80% of alive trees have a condition of good and vigor of 1.

Re-surveyed trees in 2024 have higher vigor in Chelsea and Holyoke than in 2017

## Land Use and Site Type

### Site Type:

Sidewalk planting strips, cutouts, and side yards have high survivorship in both cities

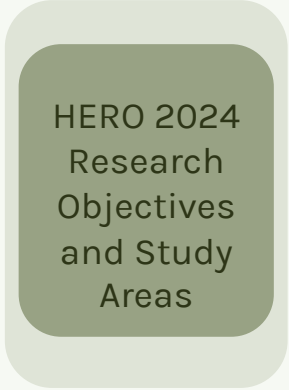

Backyard trees and maintained park trees have lower survivorship

### Land Use:

Institutional is the largest land use type in Holyoke and has the lowest survivorship

Site Type has an impact on tree survivorship across both cities





HERO 2024  
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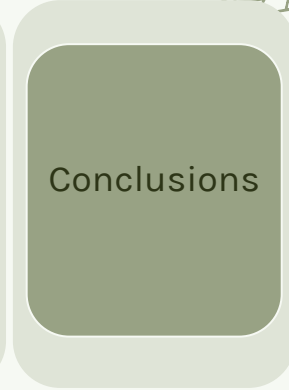
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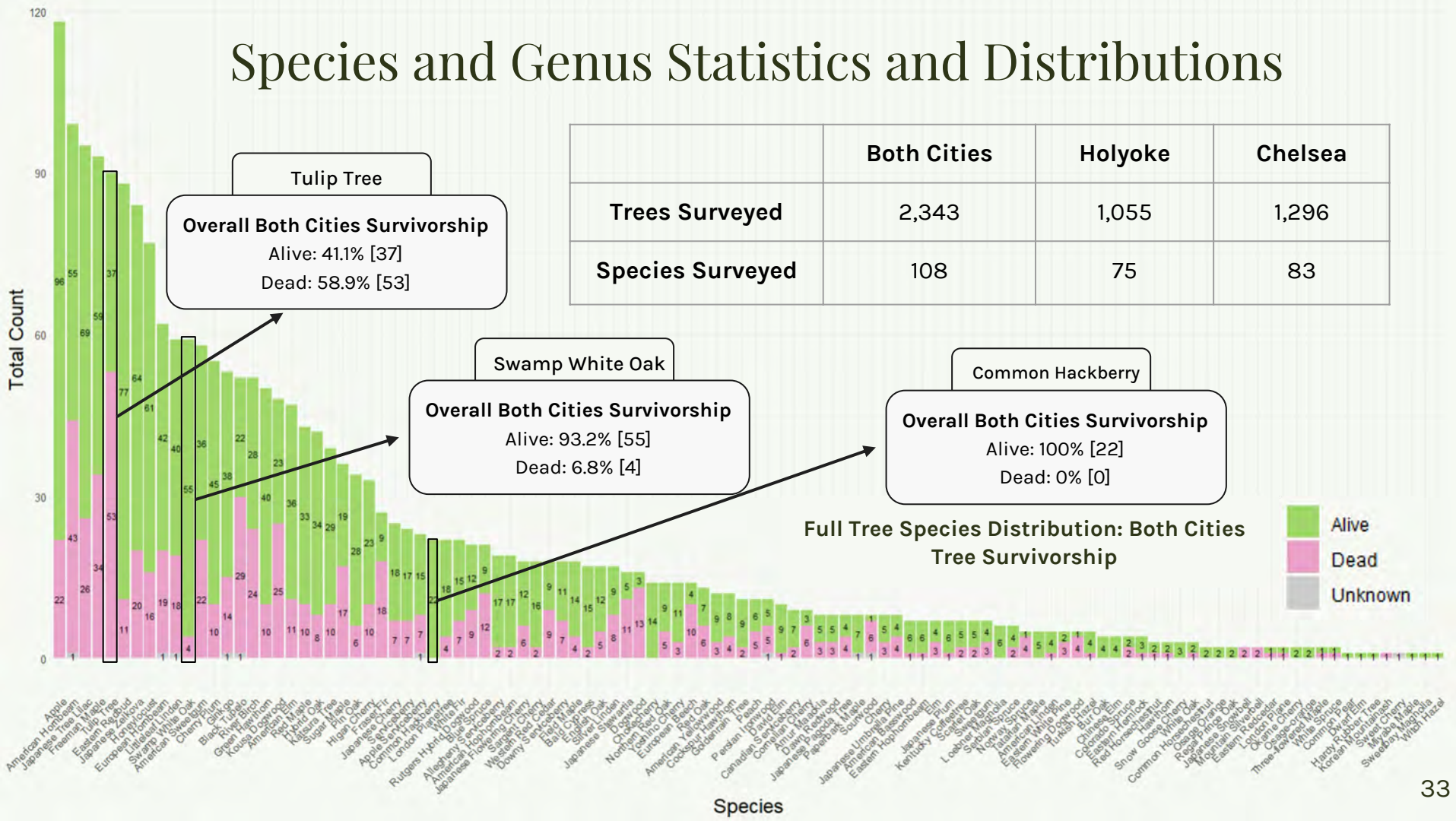


Conclusions

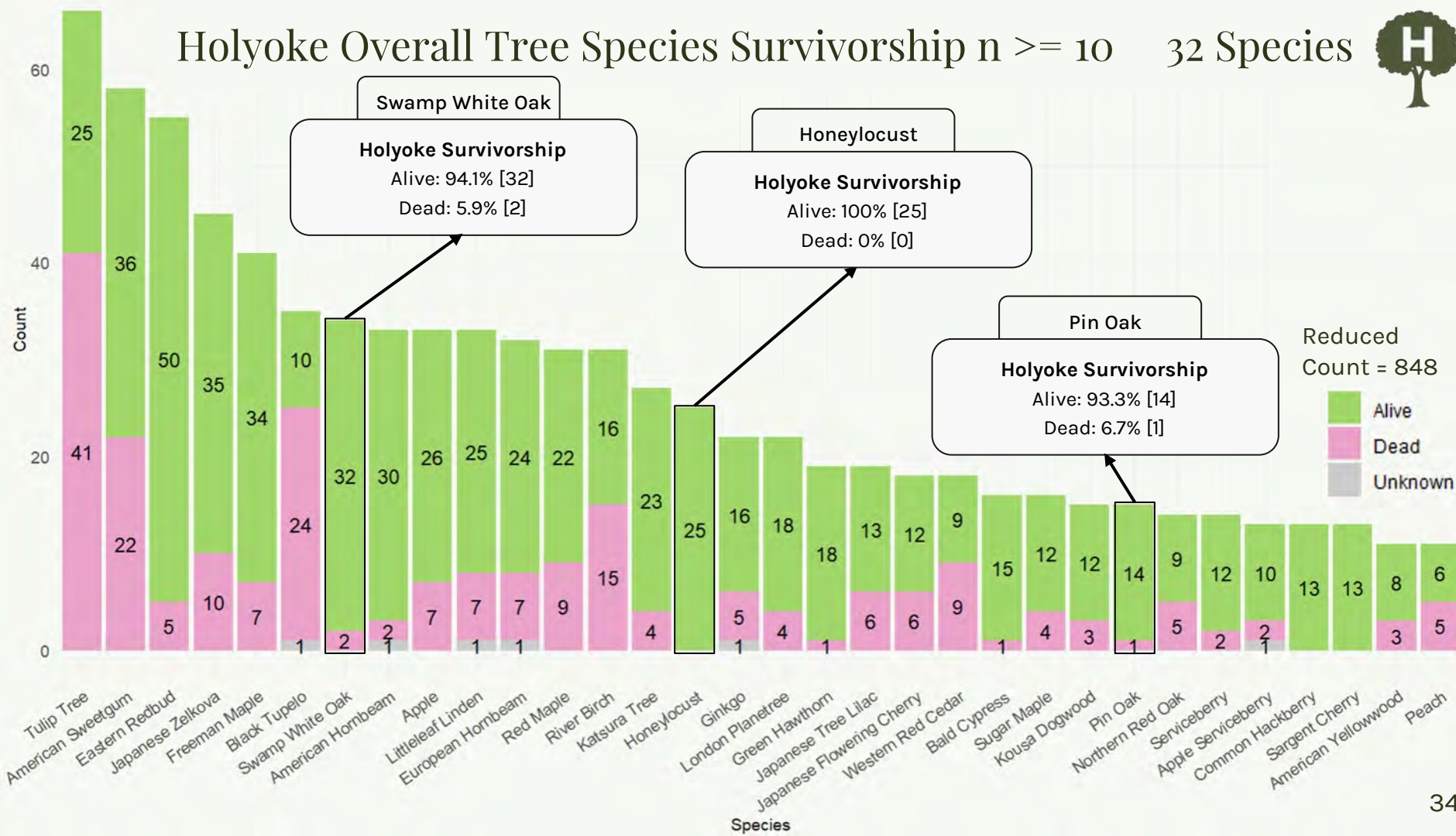




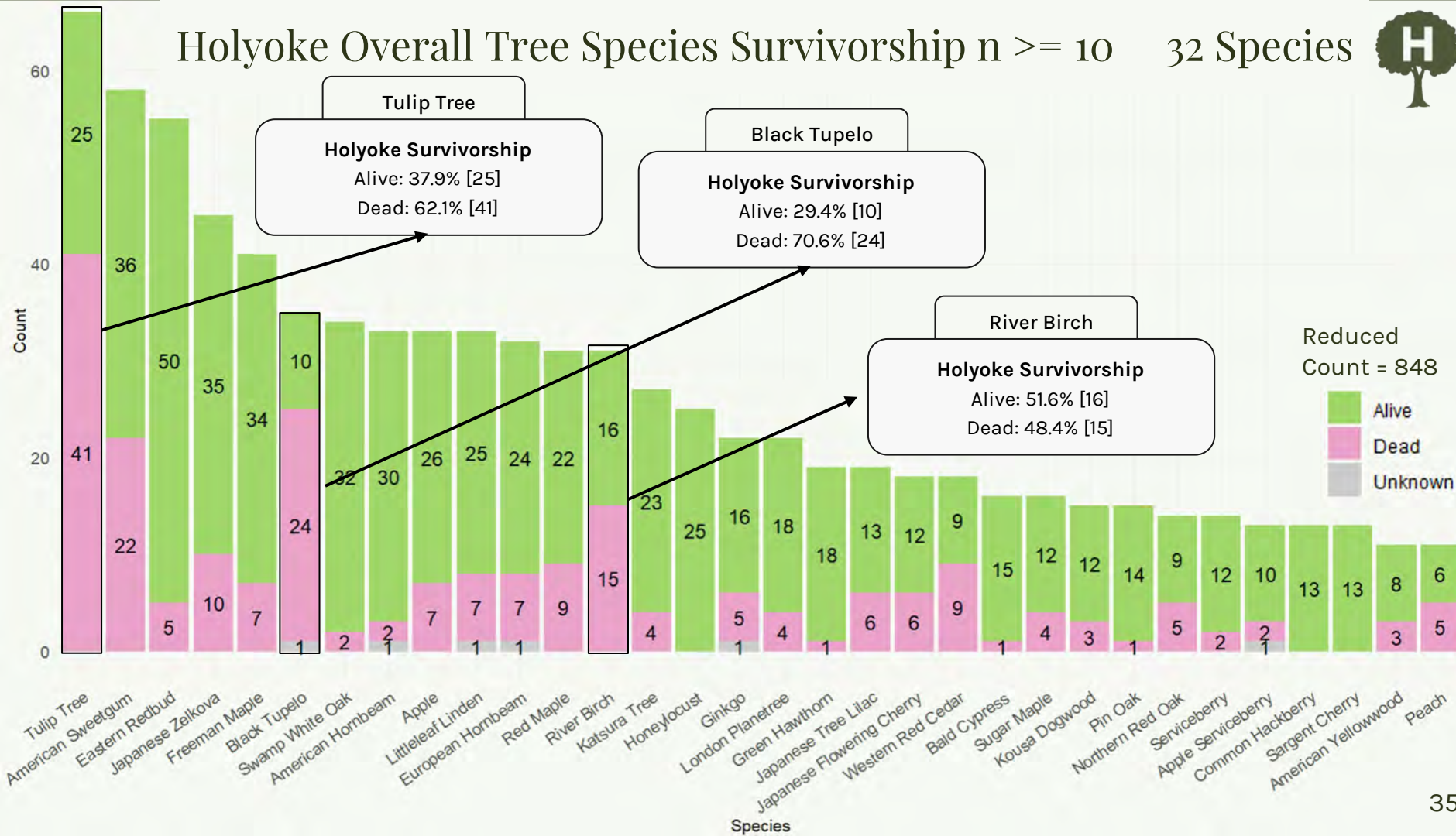
# Species and Genus Statistics and Distributions



# Holyoke Overall Tree Species Survivorship $n \geq 10$ 32 Species



# Holyoke Overall Tree Species Survivorship $n \geq 10$ 32 Species



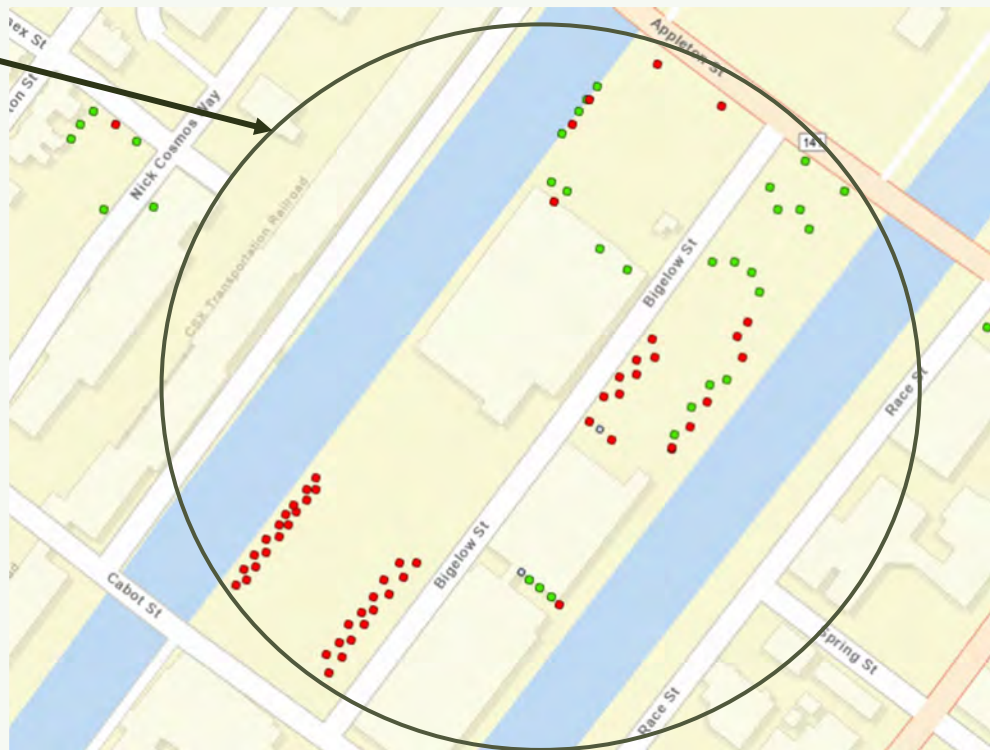




# Survivorship statistics are heavily influenced by individual sites with lots of trees

- Example: 100 Bigelow Street, Holyoke: **60 / 87** trees removed as of 2024.
- If you remove this single property from statistical analysis:

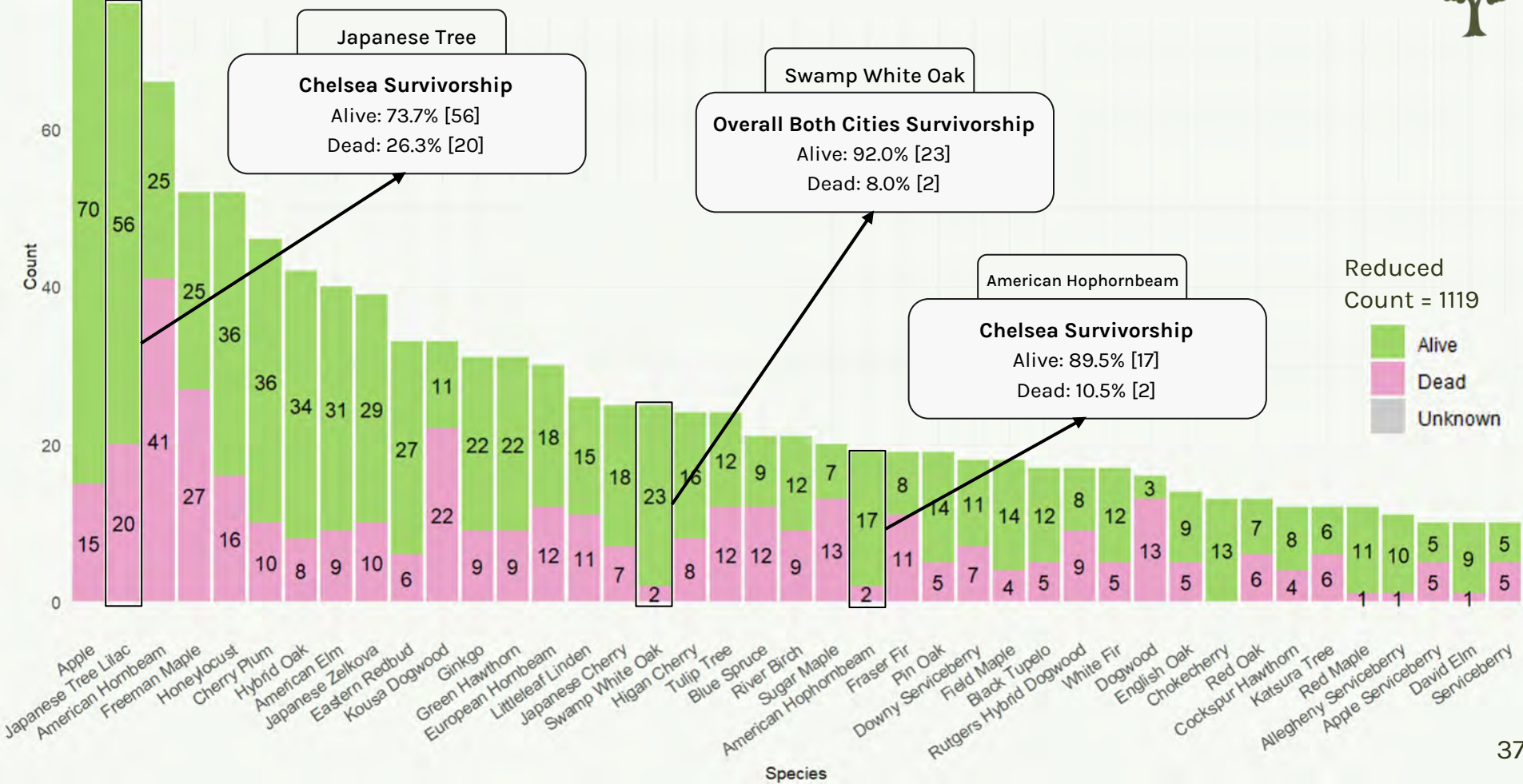
Species	Percent Change in Overall Survivorship without 100 Bigelow
American Sweetgum	+ 10.02
Black Tupelo	+ 33.09
Tulip Tree	+ 10.12
River Birch	+ 24.86





# Chelsea Overall Tree Species Survivorship $n \geq 10$

41 Species

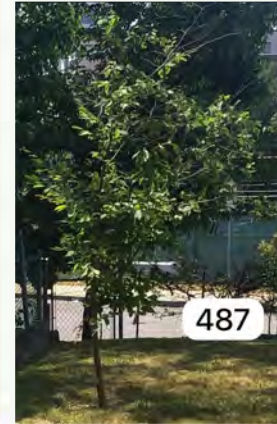
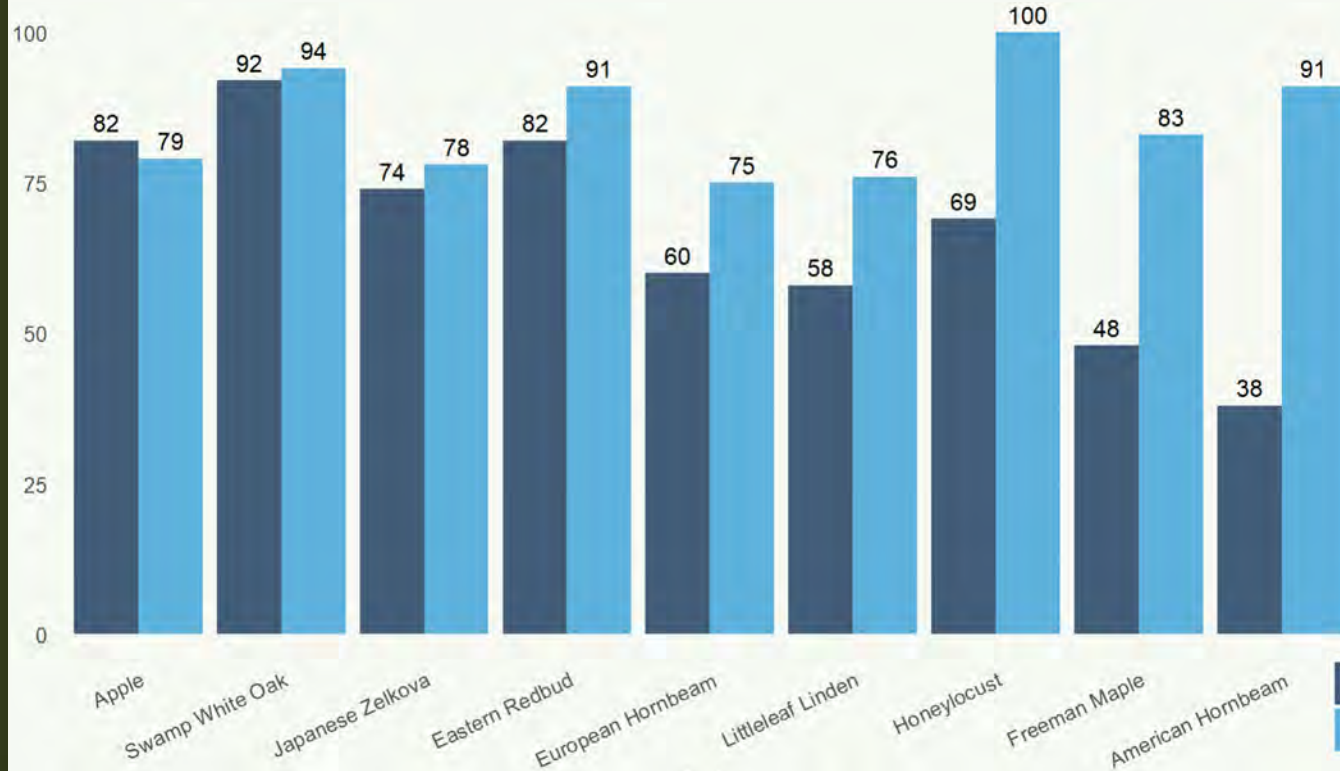


# Chelsea Overall Tree Species Survivorship $n \geq 10$

41 Species



# Percent Survivorship Comparison Between Chelsea and Holyoke



*American  
Hornbeams:  
Above Holyoke,  
Left Chelsea*



Chelsea  
 Holyoke  
 Reduced Count = 739

# DCR/GGCP Tree Categories (March 2024)

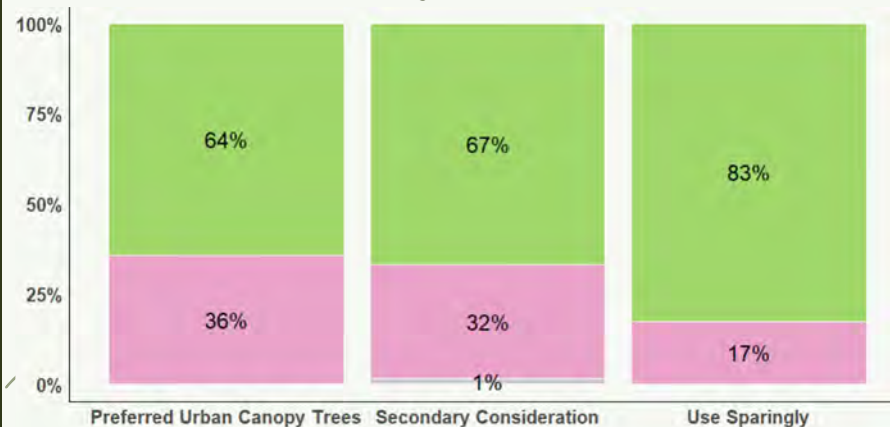
## Survivorship Distribution

	Preferred	Secondary	Sparingly
Examples	Honeylocust, Black Tupelo, Oaks (non Fastigiata), American Elm, Tulip Tree	Red Maple, Freeman Maple, Evergreens, Fastigiata	Dogwood, Apple, Japanese Tree Lilac

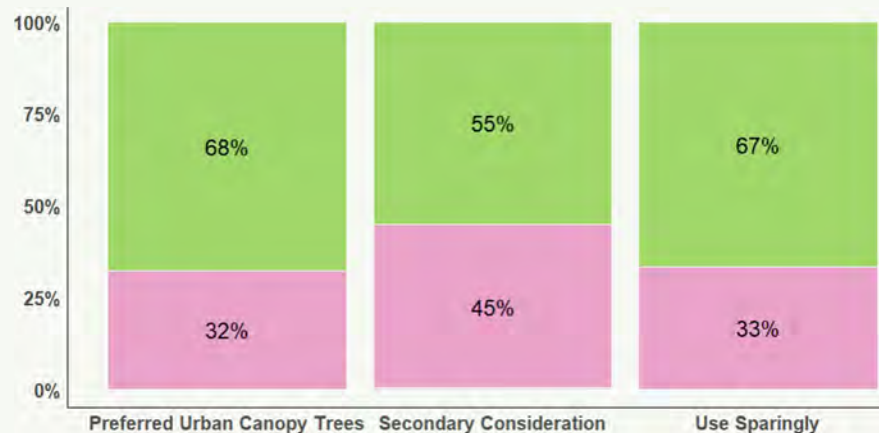
Honeylocust (*Gleditsia triacanthos*)  
in a Sidewalk Cutout



Holyoke n=699



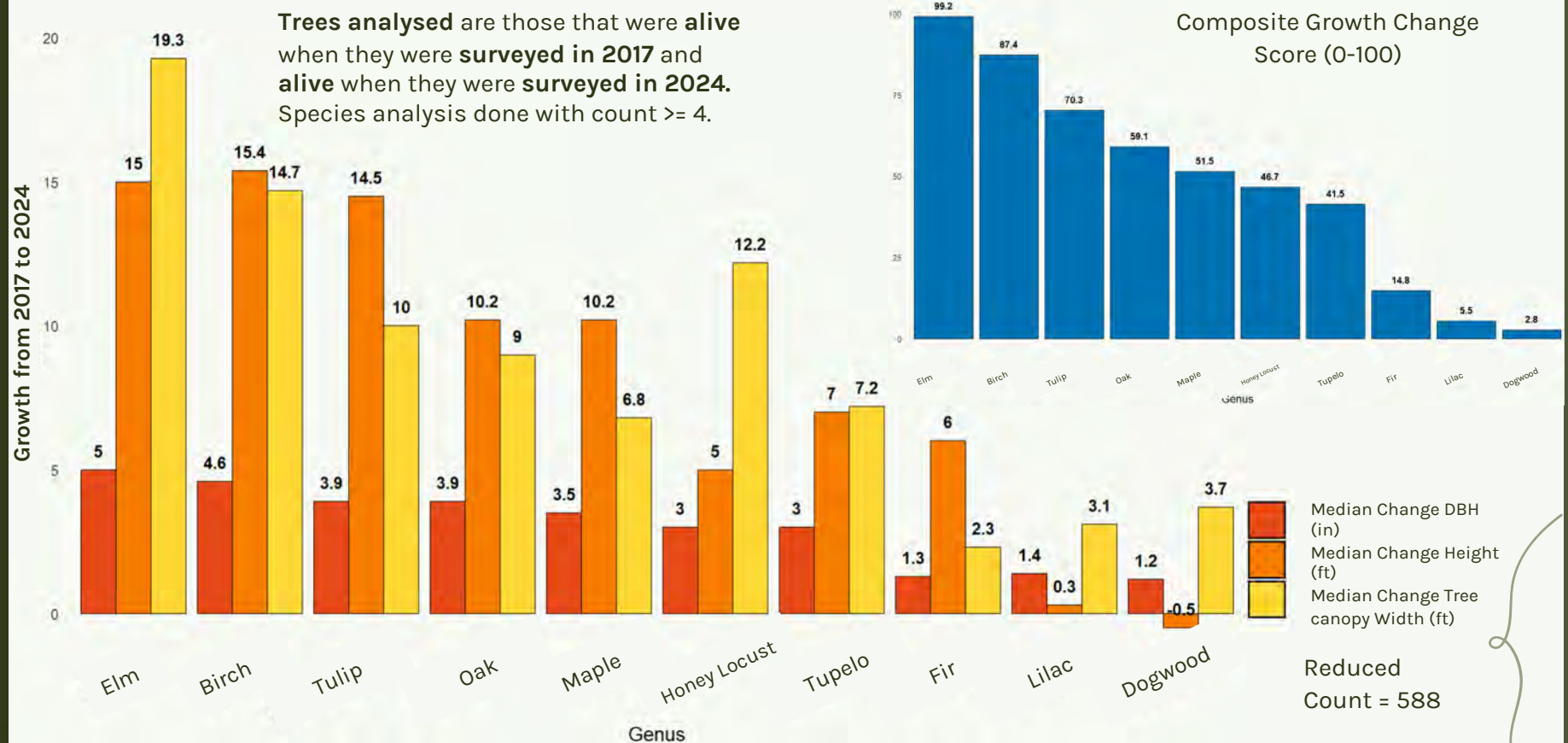
Chelsea n=856





# Tree Growth Measures: Change by Genus

**Trees analysed** are those that were **alive** when they were **surveyed in 2017** and **alive** when they were **surveyed in 2024**.  
Species analysis done with count  $\geq 4$ .





# Notable Tree Genus Composite Growth Index

	Species	Success Index	Resurvey Survivorship	Growth Index	Count
Top 4	Elm	83.5	60%	99.2	12
	Birch	69.3	42%	87.4	7
	Oak	61.5	65%	59.1	84
	Honey Locust	61.3	83%	46.7	54
Bottom 4	Tulip	59.1	43%	70.3	22
	Maple	58.9	70%	51.1	84
	Sweetgum	56.0	63%	51.7	30
	Apple	41.4	68%	23.7	48
	Lilac	31.8	71%	5.5	24
	Tupelo	31.6	17%	41.5	5
	Fir	25.3	41%	14.8	5
	Dogwood	11.8	25%	2.8	16

**Growth Index** combines tree growth statistics with survivorship. Growth Statistics include: **Average DBH Change**, **Average Tree Canopy Width Change**, **Average Height Change** (for each species).

**All Statistics are normalized** on a scale from 0-1 (0-100 for visualization purposes)

**Success Index** is  $((\text{dbh} + \text{width} + \text{height} + 2(\text{survivorship}))/5)$

This **combined metric** analyses **two parts of tree stewardship**: **natural aspects** like expected growth of a tree, and **social aspects** like stewardship and site types which affect survivorship.

Table includes 4 Highest and Lowest Composite Growth Index values, and 4 other notable trees



# High Performing Tree Species and Genera

**Elm (*Ulmus*):** Highest (Genus) Growth Index and High Overall Survivorship.



**American Elm (*Ulmus americana*)**

**Oak (*Quercus*):** High Growth Index, Very High Survivorship in Holyoke, Good Survivorship in Chelsea

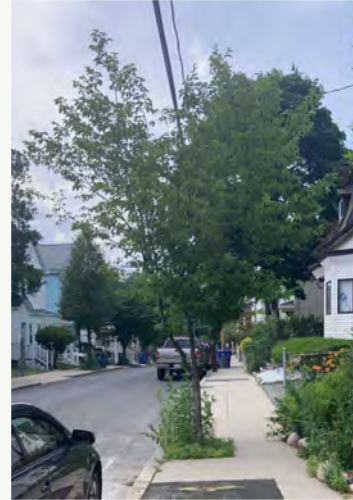


**Swamp White Oak (*Quercus bicolor*):** High Growth Index and Highest Overall Survivorship (n >= 25)



**Pin Oak (*Quercus palustris*):** High Growth Index, Very High Survivorship in Holyoke, High Survivorship in Chelsea

**Hop-hornbeam (*Ostrya*)**




**American Hophornbeam (*Ostrya virginiana*):** High Survivorship, yet low survey count.

**Birch (*Betula*)**



**River Birch (*Betula nigra*):** Very High Growth Index, High Survivorship in Holyoke, and Average Survivorship in Chelsea





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# Stakeholder Interview Analysis

## Who are the stakeholders?

- Residents, NGOs, city officials, DCR employees
  - **City partners** includes NGOs and city officials



*Espi and Aidan conducting an interview with a resident in Holyoke*

## For Residents

1. How do residents perceive the role of trees & DCR's tree planting initiative on their property and in their neighborhood?
2. How do residents' past experiences and beliefs impact tree stewardship?

## For Community Partners/DCR employees

1. How do city partners and the DCR collaborate — with each other and with residents — to maximize outreach and education surrounding the GGCP and other tree planting initiatives?
2. How have community partners' partnerships and philosophies surrounding inclusion evolved to create a lasting impact and educate residents about tree stewardship?



# Interview Summary

## Residents, City Partners and DCR Employees Contacted

- Recruited interview subjects through **phone calls** and **convenience sampling**
  - Phone numbers provided by the DCR via a call list based on residents whose property received a GGCP tree, a total of **498** phone calls were made.
  - Spanish interview translation for Spanish-speaking residents
- **27** interviews conducted in Holyoke
  - **22 residents**
  - **5 community partners**
- **24** interviews conducted in Chelsea
  - **19 residents**
  - **5 community partners**
- **3** interviews conducted in Spanish and translated to English
- Total number of interviews conducted: **51**
  - **41 residents**
  - **10 community partners**

## Planted Trees Associated with Interviews

- **124 trees**
- **30%** of trees associated with interviews planted by GGCP but not part of our sample
- **84%** average survivorship for interviewee's trees



*Adlai, Jack and Espi (not pictured) conducting a phone interview with a resident in Holyoke*



# Community Organizations and City Department Partners

## Holyoke

- City of Holyoke Conservation and Sustainability Department (Current, **Interviewed**)
- OneHolyoke (Current, **Interviewed**)
- Nuestras Raíces (Former, **Interviewed**)
- Valley Opportunity Council (Former)



## Chelsea

- City of Chelsea Department of Public Works (Current, **Interviewed**)
- GreenRoots (Former)
- La Colaborativa (Former)
- Mystic River Watershed Association (Prospective Partner)



# Holyoke Interview Location and Demographics

Demographics	Holyoke	Interviewees
Population	37,628	22
Median Age	37.5	55-64
Bachelor's Degree	22.20%	47.62%
% Renters	58.50%	4.76%
Percent Hispanic	51.70%	23.53%
Percent White	67.50%	70.59%
Median Household Income	\$49,007	\$75,000-\$99,999
English Only Household	57.30%	60%

= field not representative of city demographics

- Male to female ratio (interviewees): **52% female**
- Average years lived in home (interviewees): **25 years**
- Interviewee demographics probably representative of DCR contact list

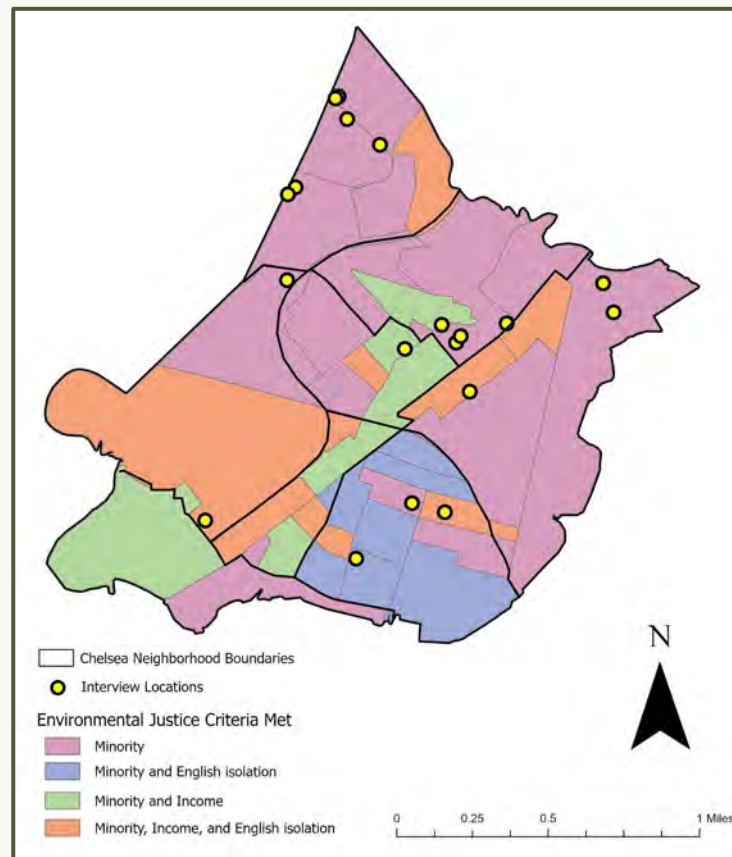


# Chelsea Interview Location and Demographics

Demographics	Chelsea	Interviewees
Population	40,787	18
Median Age	34.5	65+
Bachelor's Degree	21.60%	55.56%
% Renters	72.10%	5.56%
Percent Hispanic	67.40%	22.22%
Percent White	33.90%	72.22%
Median Household Income	\$71,051	\$100,000- \$149,999
English Only Household	29.00%	61.11%

  = field not representative of city demographics

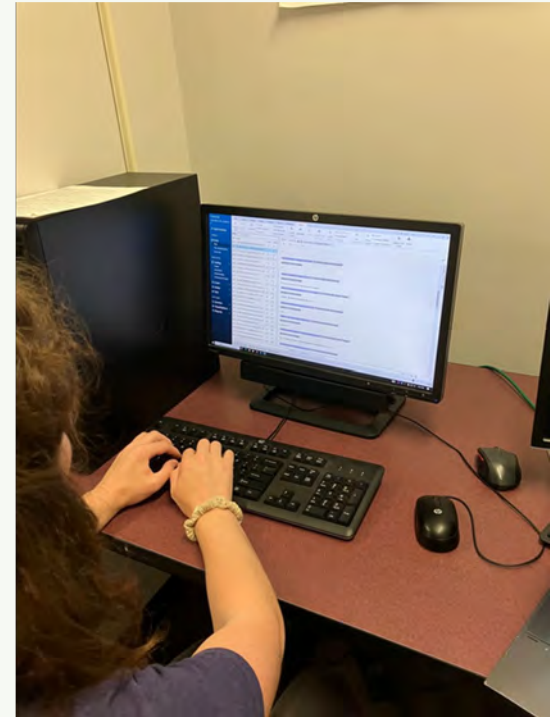
- Male to female ratio (interviewees): **61% female**
- Average years lived in home (interviewees): **23.25 years**
- Interviewee demographics probably representative of DCR contact list





# Processing Interviews

1. **Transcribe** interviews manually and using automatic transcription software
  - a. Translated Spanish interviews to English
1. Process interview transcripts using the **Nvivo qualitative analysis software**
  - a. **Assign attributes** to interviews to understand how demographics impact our sample
  - b. Sort quotes into appropriate **codes**
  - c. Code each interview by two HERO team members to ensure **intercoder reliability**
1. Assess emerging themes based on fully coded interview dataset, to understand residents' opinions, perceptions, and experiences with trees and the DCR's planting program



*HERO manager Adlai uses Nvivo software to code interviews*



# Interview Codes

## 1. Tree Health

- a. Removal

## 2. Tree Stewardship (TS)

- a. Caretaker
- b. Maintenance Activities
- c. Change in Maintenance
- d. Limitations
- e. Other Trees

## 3. Tree Perceptions (TP)

- a. Challenges
- b. Motivations
- c. Emotions

## 4. GGCP Involvement

- a. Choice
- b. Spreading the Word

## 4. Neighborhood (NB)

- a. Change
- b. Outdoor spaces

## 5. Community engagement (CE)

- a. Outreach
- b. Feeling heard

## 6. Role in the community

## 7. Environmental

### Concerns

- a. Environmental Justice

## Tree Stewardship

Maintenance Activities

Caretaker

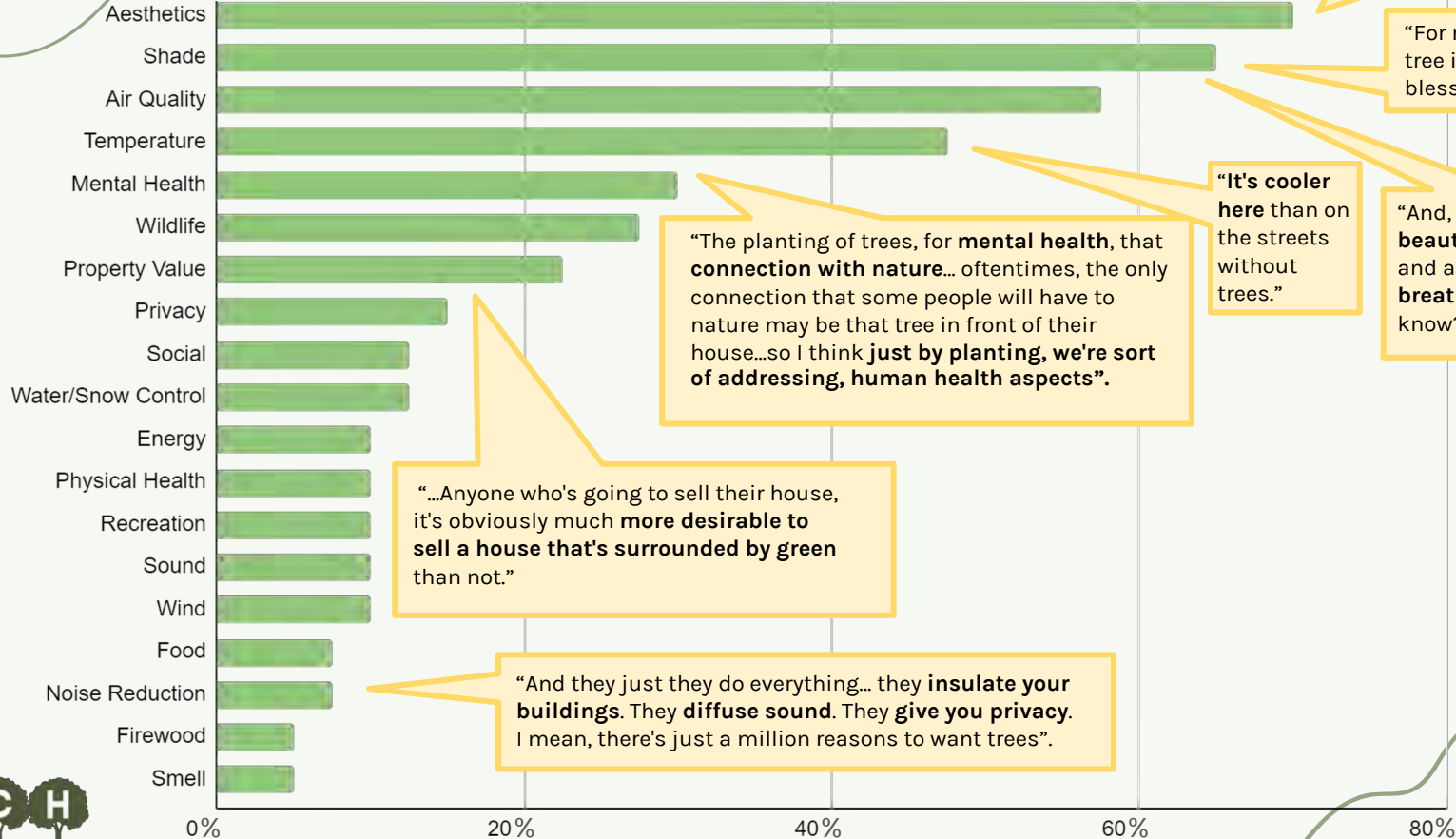
Change in Maintenance

Limitations

Other Trees



# Resident Perceived Tree Benefits



"Beauty, **sense of place**".

"For me, **the shade** of a tree is very, very blessing".

"It's cooler **here** than on the streets without trees."

"And, I mean, look at it. **So beautiful**. You know? And and and the and **when you breathe, it's so nice** You know?"

"The planting of trees, for **mental health**, that **connection with nature**... oftentimes, the only connection that some people will have to nature may be that tree in front of their house...so I think **just by planting, we're sort of addressing, human health aspects**".

"...Anyone who's going to sell their house, it's obviously much **more desirable to sell a house that's surrounded by green** than not."

"And they just they do everything... they **insulate your buildings**. They **diffuse sound**. They **give you privacy**. I mean, there's just a million reasons to want trees".



# Resident Perceived Tree Challenges

"The challenge is I have to trim them."

"every year, I have to trim that tree. And the bigger it get, **the more I have to pay** for somebody to trim it"

"We expected it to be **6 feet tall**, and it was **12 feet tall**"

"I wanted it removed from... my house because **it was causing damage** or, you know, **branches are falling [on] my car, hitting my house.**"

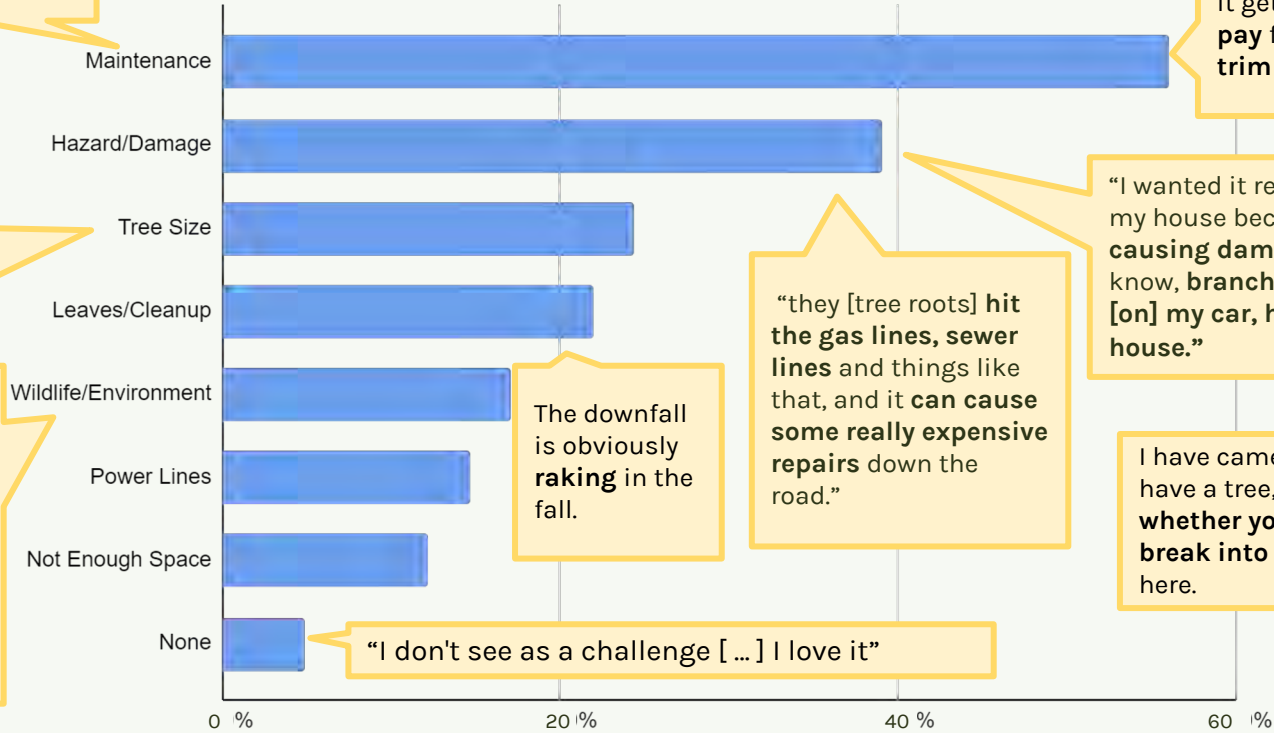
"I had them cut down because I was afraid they were **getting on the roof** and the **squirrels would get in**"

"they [tree roots] **hit the gas lines, sewer lines** and things like that, and it **can cause some really expensive repairs** down the road."

I have cameras, now I have a tree, so I **can't see whether you're trying to break into a car** out here.

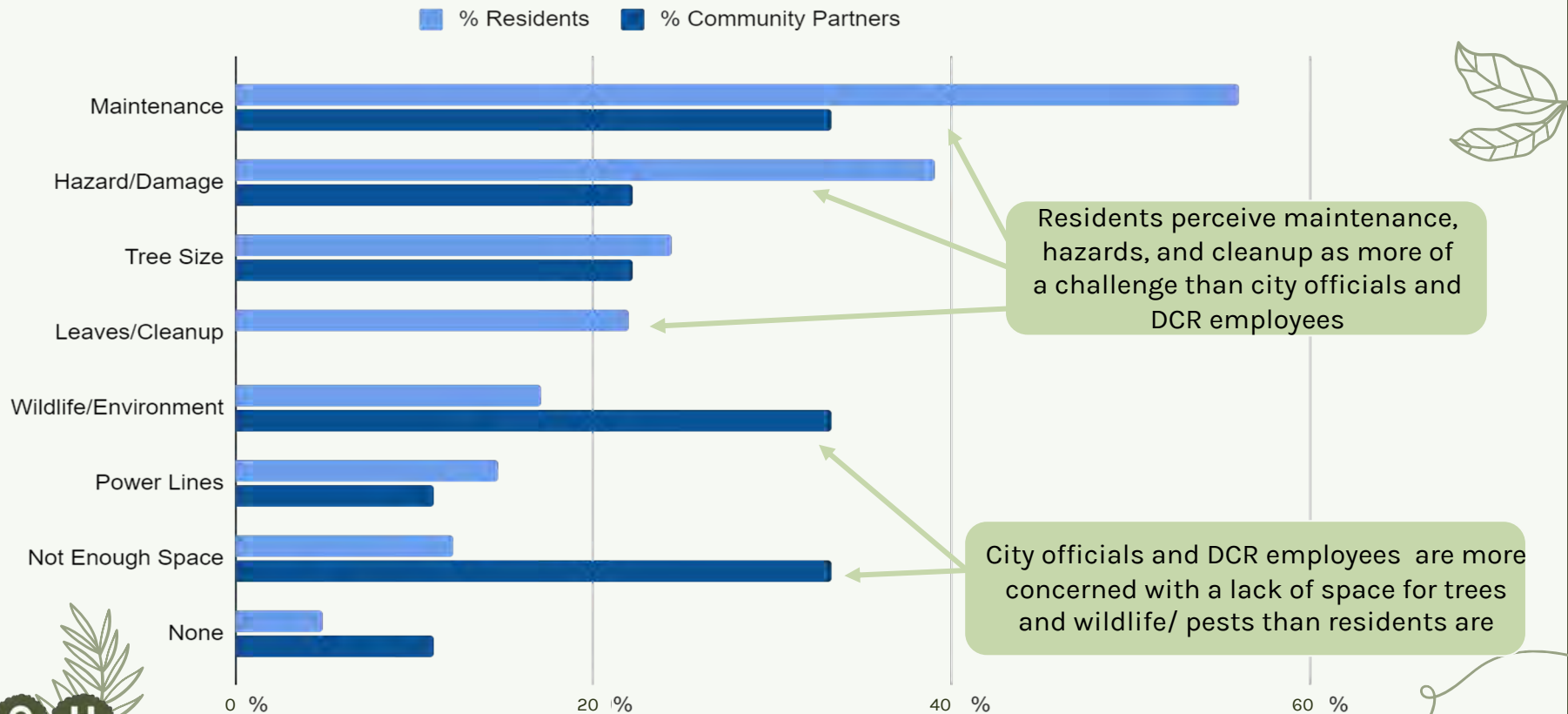
The downfall is obviously **raking** in the fall.

"I don't see as a challenge [...] I love it"





# Resident and Community Partner Tree Challenges Comparison



# Maintenance Activities



"I water it, and I give them the same thing. I give them a **Miracle Gro**"

"It kind of tilted a little bit, and I tried to **straighten it**"

"I was told to look out for **giving it water**, and I that's basically the most that I do."

"I had to trim some **limbs** so he didn't get smacked in the face."

"Put the mulch and weed **block** around it so the mower guy doesn't keep breaking branches."

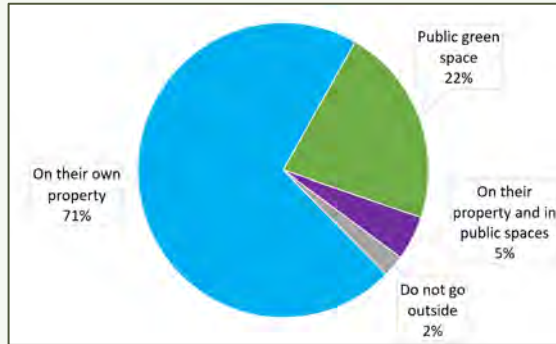
"Try to **keep trash** away from the tree."



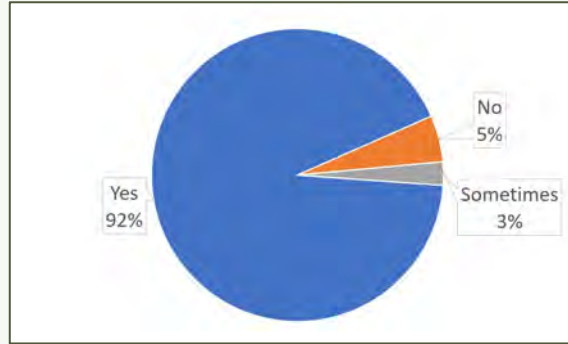
Percent of Residents who Engaged in Maintenance Activity

# Resident Perceptions of Yards and Outdoor Space

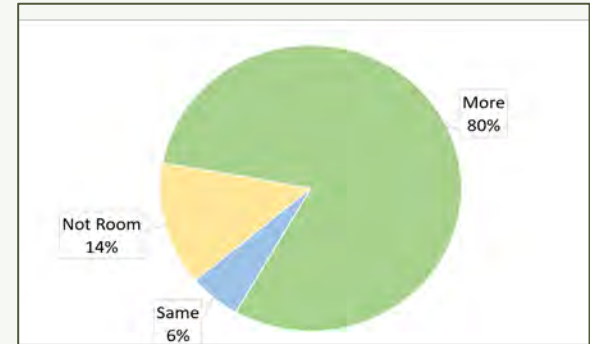
Q: Where do you typically spend time outside?



Q: Do you feel like the outdoor spaces you spend time in are well suited to your needs?



Q: Do you think your neighborhood should have more trees, fewer trees, or the same?



"I think that some of the parks need... I think **they need an arborist to come in** because **they're just well overgrown.**"

"I wish there were places closer to me where I could just go sit in the park. We do have some good parks here. My ideal neighborhood would have more of them"

"If I didn't have this yard, no. I wouldn't feel like they were suited to my needs. Would I walk to a park if there were one? Yeah. But **where is a nice park kind of walkable to here?**"

"I think **the residents of Chelsea** deserve much more green spaces"



# Residents Feel Heard in Local Decision Making

Q: Do you feel listened to in decision making processes surrounding parks, trees, or outdoor spaces in your community?

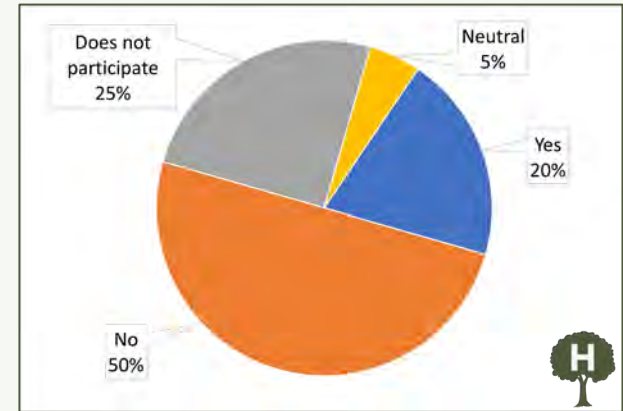
"As far as local parks, **I don't know that any citizen has a voice.** I think it's what business is funding, what campaign will drive the decisions"

"I don't actually feel like there's a big conversation happening around that here in the city of Holyoke, **I don't feel asked**"

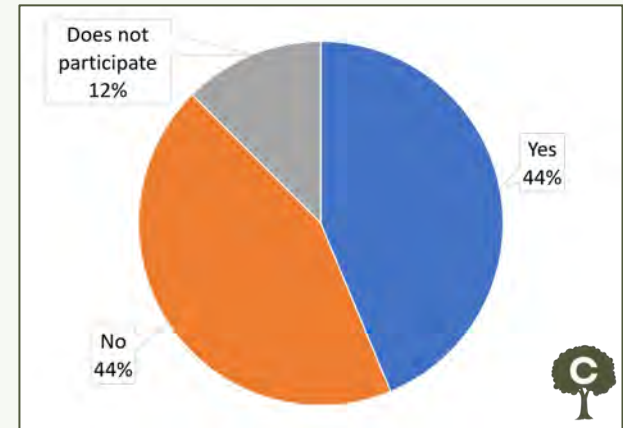
"I do in Chelsea. I think that Chelsea's done a lot, and Everett seems to be doing a lot. It seems like Everett's doing more, but **Chelsea seems to do a real lot.**"

"Sometimes I feel like **they don't expect us to really get involved**"

Holyoke:



Chelsea:



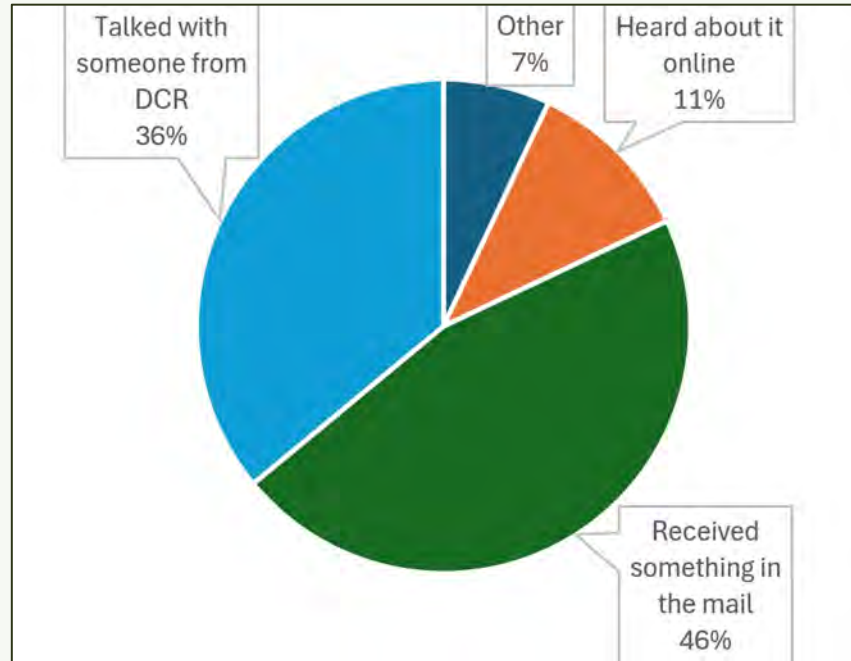


# GGCP Outreach to Residents

**"I mean, I loved how they came around, and they had the little flip book with the photos to show you, different trees and a kind of sheet with information about them. It was really helpful"**

**"I think there's also, there should be more advertisement, promotion, not too many people know about it"**

How residents first became aware of the GGCP:



# Resident Roles in the GGCP

## Residents as Communicators

- 75% of interviewed residents spoke about the GGCP to others
- 51% spoke about the program with neighbors

**“I talked to my neighbors** about getting some more trees. I think **one of them did get a tree**”

**“ I told my friend,** and then she told her mom”



*Front yard plum tree in Holyoke*

## Residents as Negotiators

- 100% of interviewed residents chose the **location(s)** of their tree(s)
- 95% chose the **species**
- 77.5% received the tree(s) they originally requested

**“I did** [choose the location]. The location had to be moved a little bit because I had an irrigation system. They were a little concerned about hitting it.”

In Leominster, Pittsfield, Fall River and Chicopee:  
31% communicated with family and neighbors  
69% percent residents as negotiators

Geron et al., 2023



# Creating and Maintaining Good Partnerships

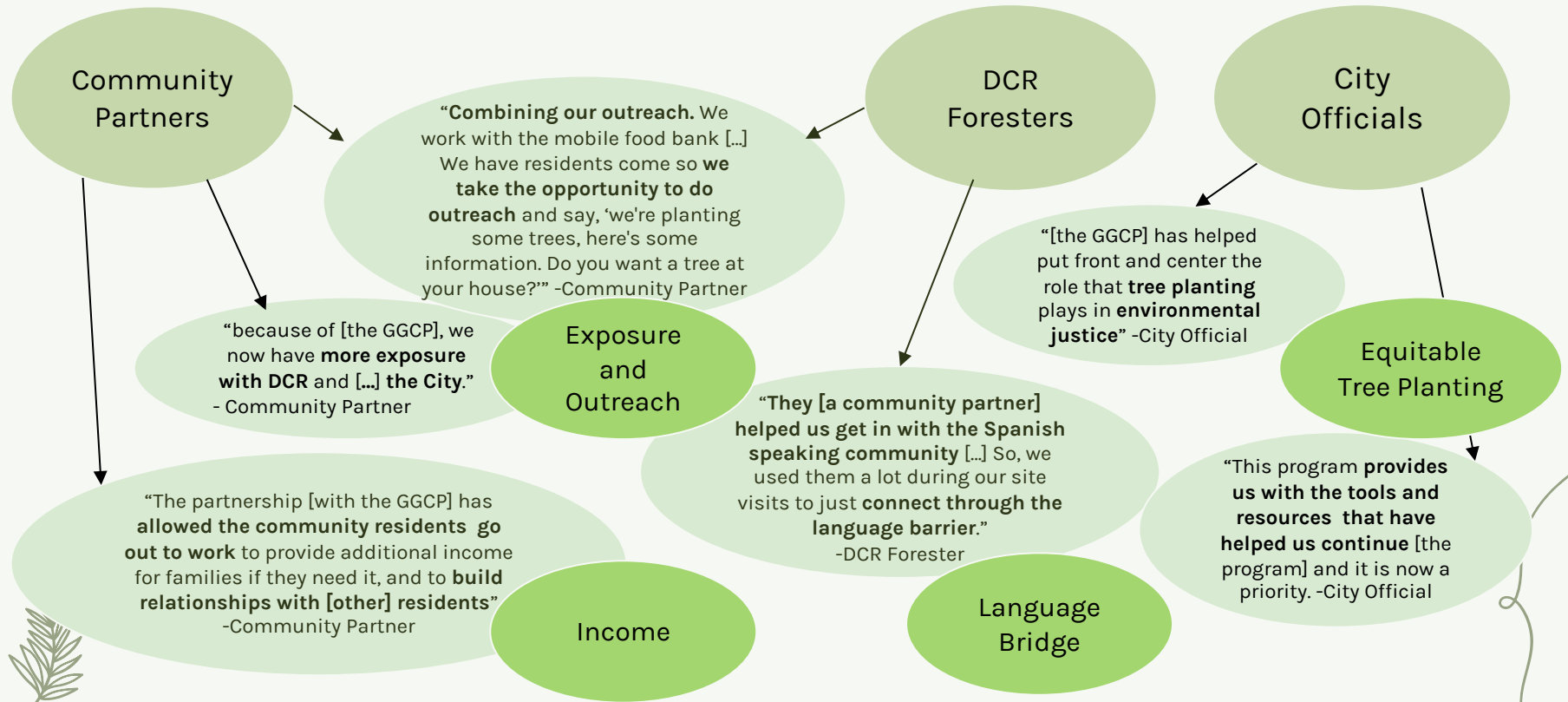


# Outreach Challenges Faced by Foresters





# Community Partnership Benefits



# Summary of Interview Analysis

## Residents

**Tree Benefits:** Aesthetics, shade, air quality, and mental health

**Tree Challenges:** Maintenance and hazards

**Tree Maintenance:** watering, pruning, and mulching

Many residents reported that their trees were **larger than expected** and felt misled by foresters.

Residents were asked to **rate their experience with GGCP trees**, the average rating was **9.3 / 10**

## City Officials, Community Partners, DCR Employees

DCR is trying to **enhance communication** with community and city partners


DCR Foresters highlighted **language barriers** as the **biggest challenge** surrounding community outreach

**Community partner** organizations are **instrumental** in multilingual outreach



*Entering Chelsea sign from the Everett border*






HERO 2024  
Research  
Objectives  
and Study  
Areas

Biophysical  
Field  
Methods  
and Data  
Collection

Tree  
Assessments  
and Statistics

Species  
and  
Growth  
Analysis

Interview  
Analysis  
and  
Takeaways



Conclusions  
and Future  
Research



# Key Takeaways from Our Study

## Tree Species

5 High Performance* Tree Species	3 Low Performance** Tree Species
American Elm	Dogwood spp.
Swamp White Oak	Kousa Dogwood
Scarlet Oak	Black Tupelo
Pin Oak	
River Birch	

\*high growth index and survivorship

\*\*poor growth index and low survivorship

## Tree Health

Public trees had higher survivorship than private trees

Street trees had high survivorship in both cities.

### Land Use:

- **Institutional** had most trees planted but lowest survivorship in Holyoke (similar to findings in Breger et al. 2019)
- **Multifamily** had most trees planted but low survivorship in Chelsea.

Majority (>80%) of surviving trees had **Vigor of 1 and Condition of Good.**

## Community Perceptions

### Benefits

- Residents value trees for their **Aesthetics, Shade, and Air Quality** benefits
- **80%** of residents want more trees in their neighborhood
- **Partnerships around GGCP** allow for combined and increased **outreach, multilingual communication, network building, resource access**

### Challenges

- **Disconnect between the DCR and English** limited community members in both cities.
- More **community partner engagement**

Breger, B. S., Eisenman, T. S., Kremer, M. E., Roman, L. A., Martin, D. G., & Rogan, J. (2019). Urban tree survival and stewardship in a state-managed planting initiative: A case study in Holyoke, Massachusetts. *Urban Forestry & Urban Greening*, 43, 126382.



# Holyoke and Chelsea in Context

**Annual Survivorship** takes into account survivorship and the number of years since planting. This metric allows for the comparison of tree cohorts in different planting programs.

Case Studies	Establishment Annual Survivorship (0 - 5 years)	Post - Establishment Annual Survivorship (6 or more years)
National Median* (24 cases)	93.20%	96.74%
Holyoke (2014 - 2024)	95.3%	93.8%
Chelsea (2014 - 2024)	90.9%	94.2%
Worcester (2010 - 2023)	94.9%	96.8%

\*Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, 45(5), 167-200.





# Priority Areas for Future Planting



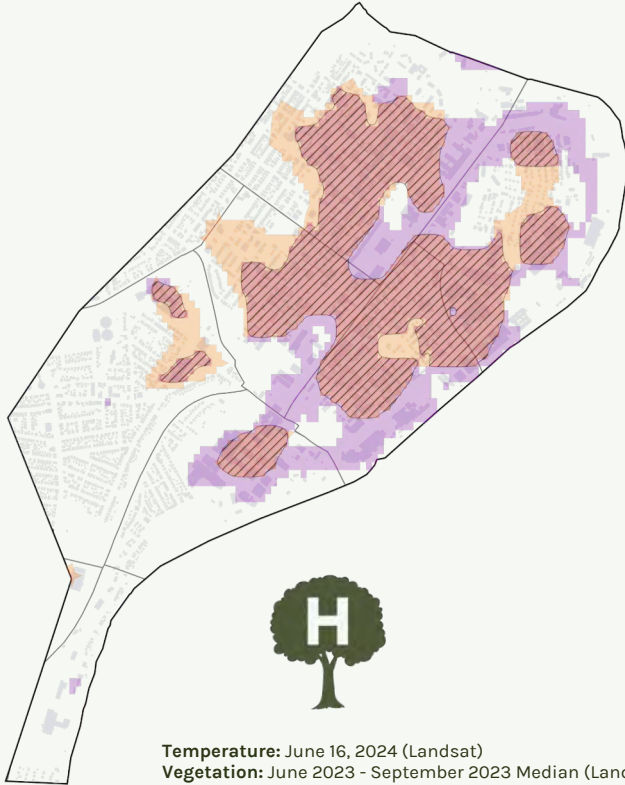
Priority Area (High Temp + Low Vegetation)



High Temperature Hot Spot

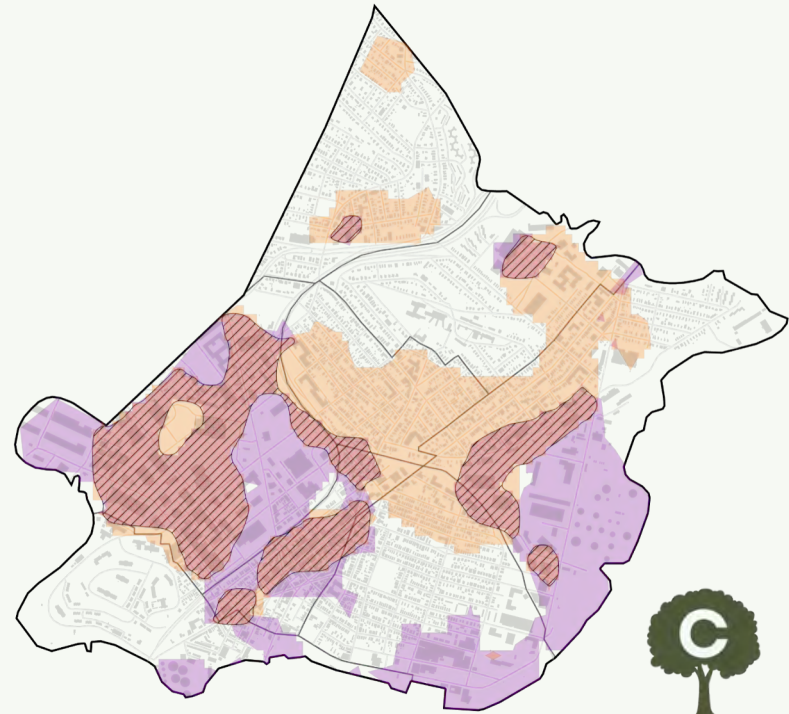


Low Vegetation Hot Spot



**Temperature:** June 16, 2024 (Landsat)

**Vegetation:** June 2023 - September 2023 Median (Landsat)



**Temperature:** July 17, 2023 (Landsat)

**Vegetation:** June 2023 - September 2023 Median (Landsat)

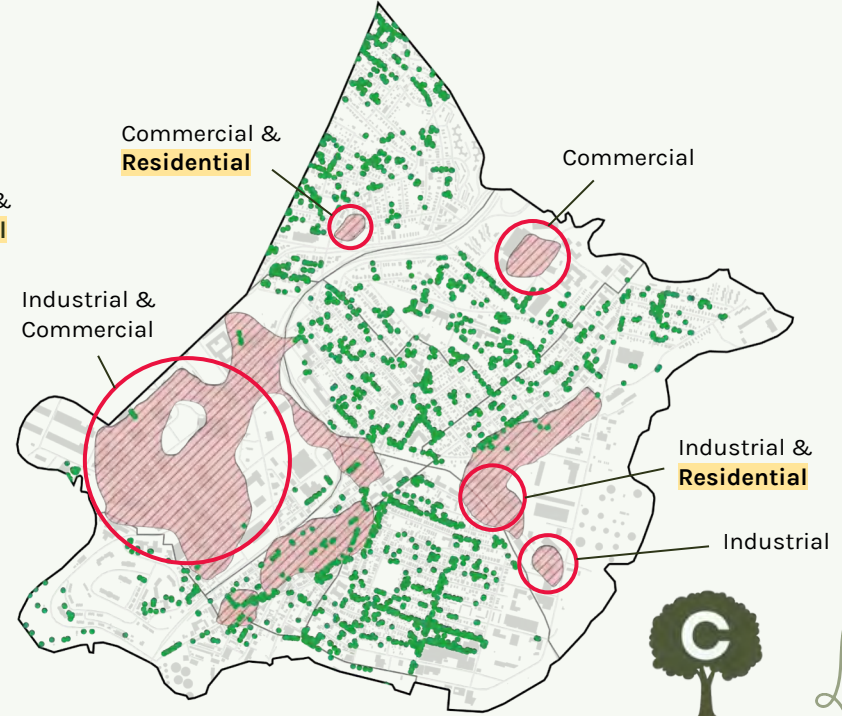
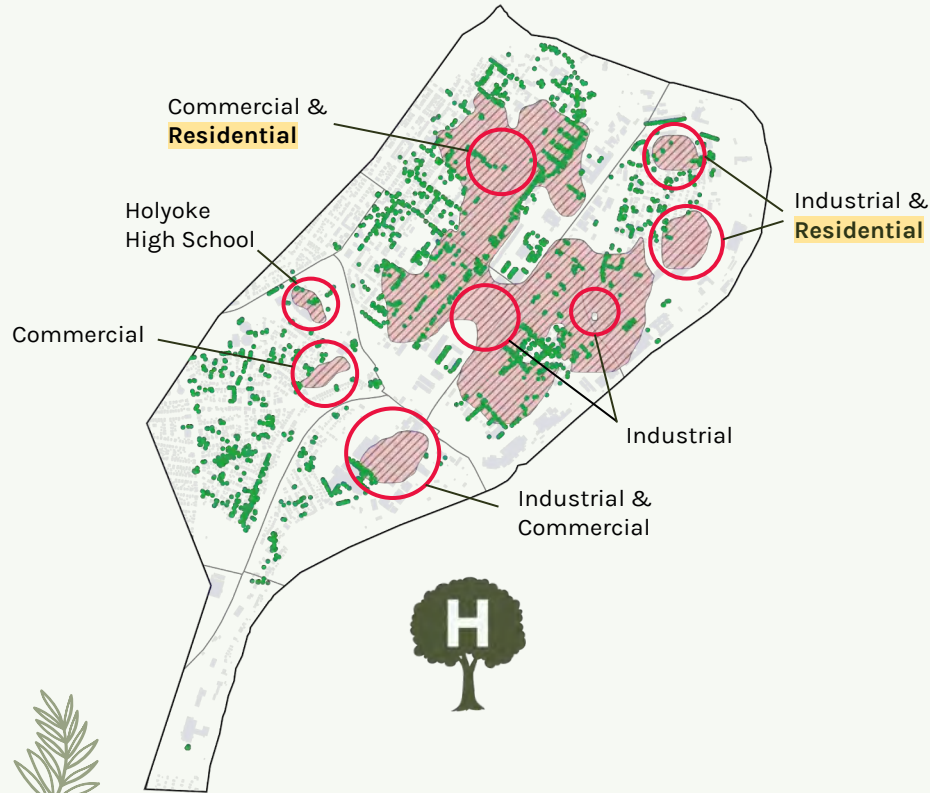
# Priority Areas & All GGCP Trees (2014-2023)



Priority Area



All GGCP trees planted since 2014



# Recommendations for GGCP

## Tree Health

An increase in support for watering of **private trees** may increase survivorship.

Encourage planting of **genera with high growth index and survivorship rates**.

Encouraging **collaboration and communication** between Gateway Cities Program foresters

More explicit maintenance agreements especially for **non residential private land receiving many trees**.



*HERO fellow, Kalon plants a dogwood with a DCR Forester*

## Environmental Justice

Increased efforts for **multilingual outreach** in GGCP cities.

Establish and **maintain strong relationships with community partners** to help increase outreach, planting, and survivorship.

Planting in **Priority Areas** could ease social and environmental disparities.



DCR Foresters

US Forest Service

GGCP Community Partners

City of Chelsea

- Department of Public Works

City of Holyoke

- Conservation and Sustainability Department

Residents in Chelsea and Holyoke

Clark Geography - Marjorie Miller and Yaa Poku

Clark Marsh Institute Staff - April Carlson

Our wonderful drivers and mentors (Jason, Adlai, Tanner, Nick, and Aidan)

And of course our fantastic Directors Doctors  
Deborah Martin and John Rogan.

# Thank You!



*Juju plants a hornbeam with a DCR Forester*





# Questions?

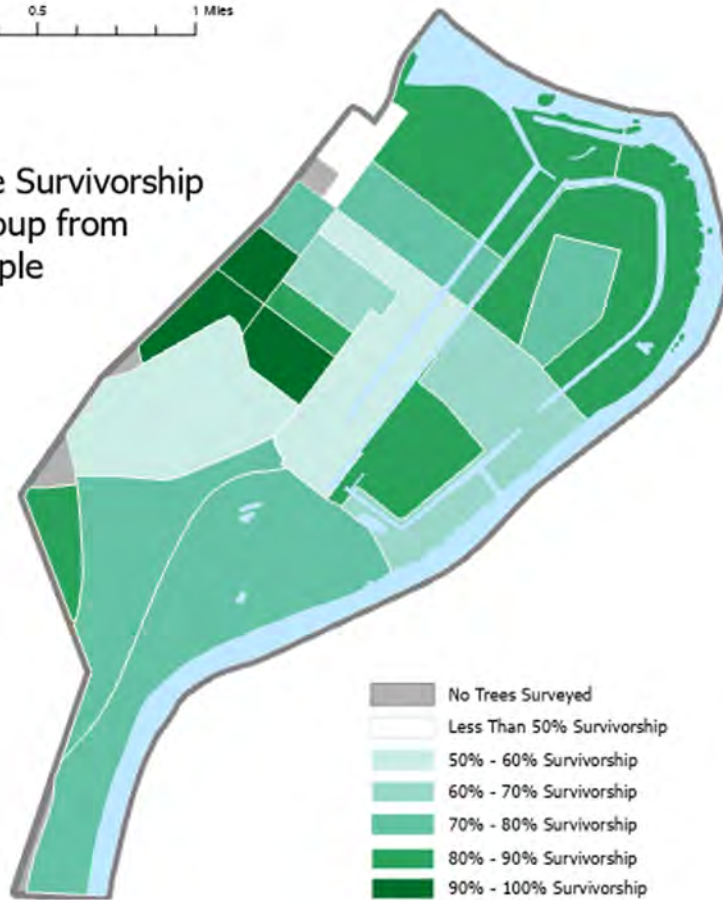




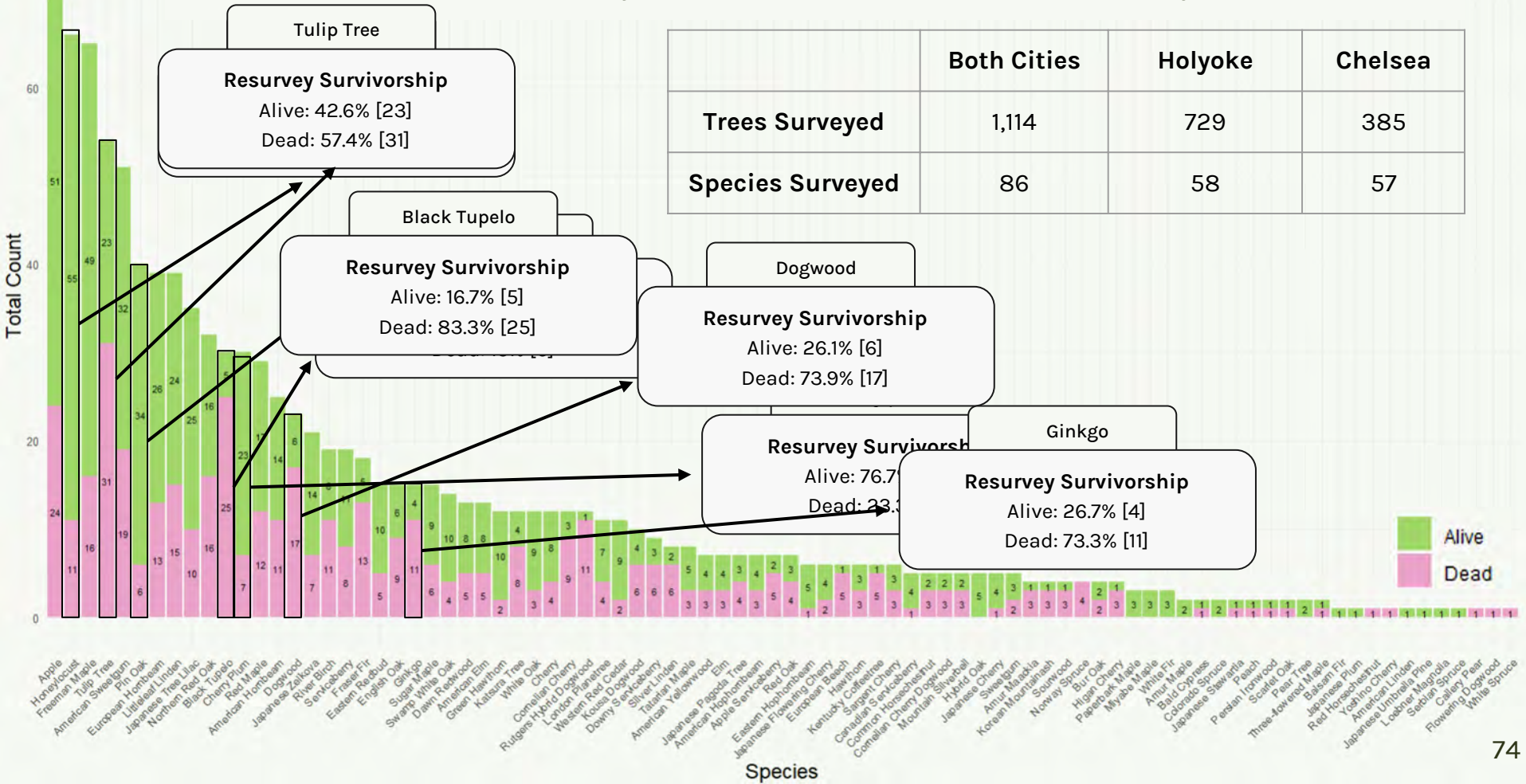
# Appendix

0 0.25 0.5 1 Miles

# Percent Tree Survivorship by Block Group from Overall Sample



# Resurvey Tree Species Summary

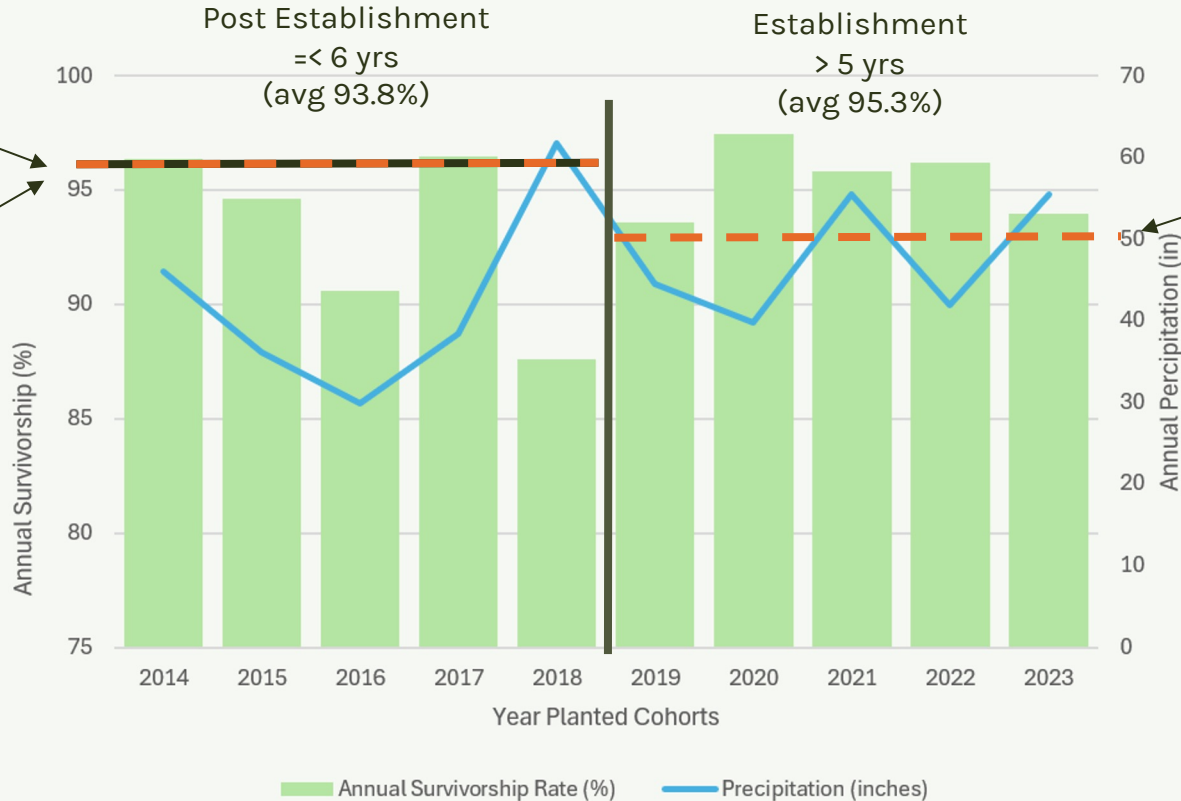




# Holyoke Annual Survivorship

**HERO 2023  
Worcester  
Annual  
Survivorship =  
96.82%**

**National  
Median Post -  
Establishment  
Survivorship  
Rate = 96.74%**

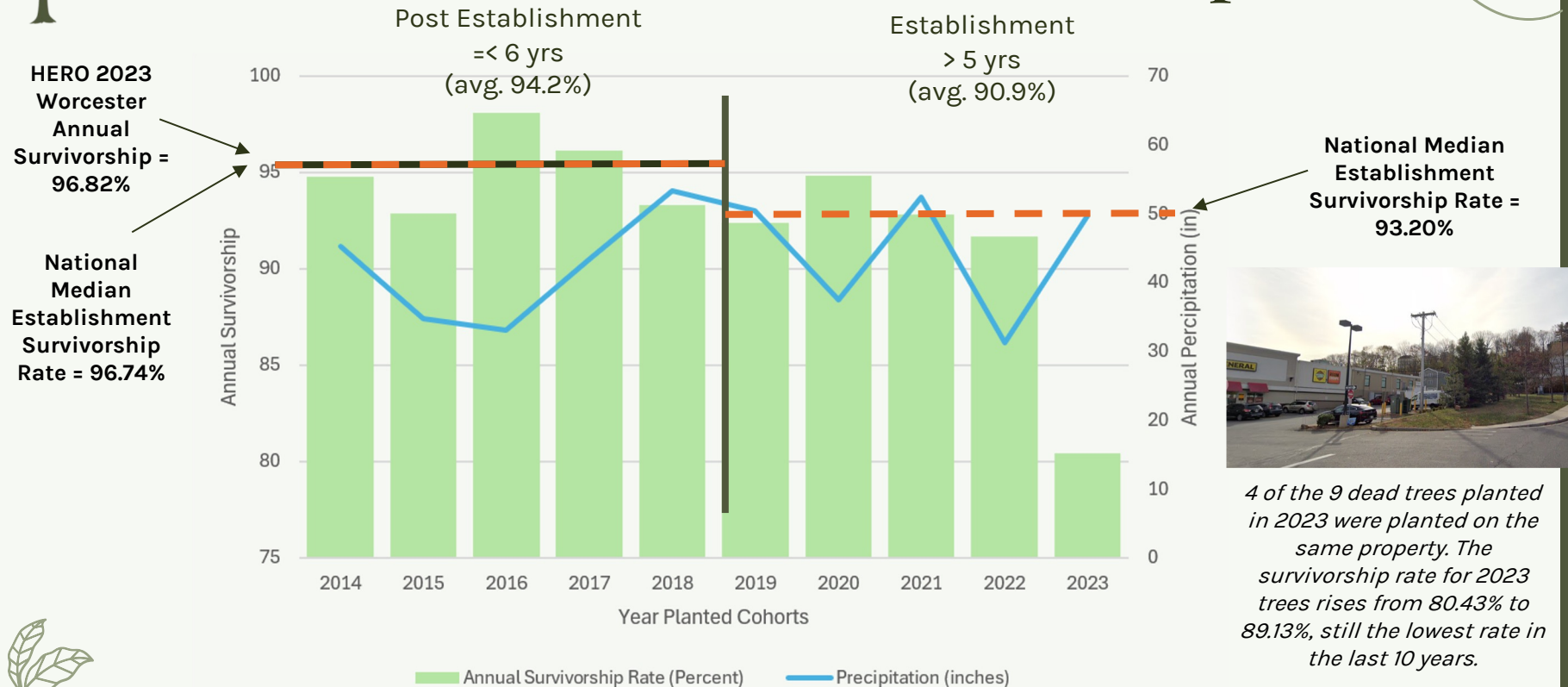


**National Median  
Establishment  
Survivorship Rate =  
93.20%**

Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, 45(5), 167-200.



# Chelsea Annual Survivorship



*4 of the 9 dead trees planted in 2023 were planted on the same property. The survivorship rate for 2023 trees rises from 80.43% to 89.13%, still the lowest rate in the last 10 years.*

Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, 45(5), 167-200.



## Chelsea and Holyoke Overall Tree Assessment Survivorship Summary by Species

Top 6 Species	Overall Survivorship	Total Surveyed	Holyoke Surv.	Holyoke n	Chelsea Surv.	Chelsea n
Swamp White Oak	93%	59	94%	34	92%	25
Eastern Redbud	88%	88	91%	55	82%	33
Cherry Plum	82%	55	100%	9	78%	46
Pin Oak	82%	34	93%	15	74%	19
Apple	81%	118	79%	33	82%	85
Hybrid Oak	81%	42	NA	NA	81%	42

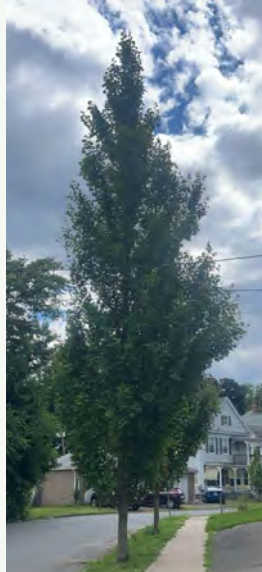
n=1566

Bottom 6 Species	Overall Survivorship	Total Surveyed	Holyoke Surv.	Holyoke n	Chelsea Surv.	Chelsea n
Tulip Tree	41%	90	38%	66	50%	24
Black Tupelo	42%	52	29%	35	71%	17
Kousa Dogwood	48%	48	80%	15	33%	33
Sugar Maple	53%	36	75%	16	35%	20
River Birch	54%	52	52%	31	57%	21
American Hornbeam	56%	99	91%	33	38%	66



# Mixed Results and Other Interesting Tree Species

**Maple (*Acer*):** Good Growth Index and Overall Survivorship



**Freeman Maple (*Acer x freemanii*):** High Growth Index, Holyoke Survivorship 35% Higher than Chelsea

**Hornbeam (*Carpinus*)**



**American hornbeam (*Carpinus caroliniana*):** Low Growth Index, Holyoke Survivorship 53% Higher than Chelsea

**Tulip (*Liriodendron*)**



**Tulip Tree (*Liriodendron tulipifera*):** High Growth Index, Very Low Survivorship in Holyoke. Possibly overplanted

**Honey Locust (*Gleditsia*)**



**Honeylocust (*Gleditsia triacanthos*):** Fair Growth index, ~100% Survivorship in Holyoke, 30% less in Chelsea

**Lilac (*Syringa*)**



**Japanese Tree Lilac (*Syringa reticulata*):** Very Low Growth Index, Good Overall Survivorship



# Low Performing Tree Species and Genera

**Dogwood (*Cornus*):** Lowest  
Growth Index (Genus), Poor  
Overall Survivorship



**Kousa Dogwood (*Cornus kousa*):** Very Low Growth Index,  
Good Survivorship in Holyoke,  
Poor Survivorship in Chelsea



**Dogwood (*Cornus* spp.):**  
Lowest Growth Index (Species),  
Very Poor Survivorship in  
Chelsea

**Tupelo (*Nyssa*)**



**Black Tupelo (*Nyssa sylvatica*):** Low Growth  
Index, Very Poor  
Survivorship in  
Holyoke, Fair  
Survivorship in  
Chelsea. Possibly  
Overplanted



# Ecosystem Services

## Holyoke

- In 2024, trees in our sample contributed over **\$2,683** worth of ecosystem services.
- Trees Sequester **2 tons** of carbon annually.
- Trees remove **32 pounds** of pollution from the air annually
- Trees produce **2.7 tons** of Oxygen annually

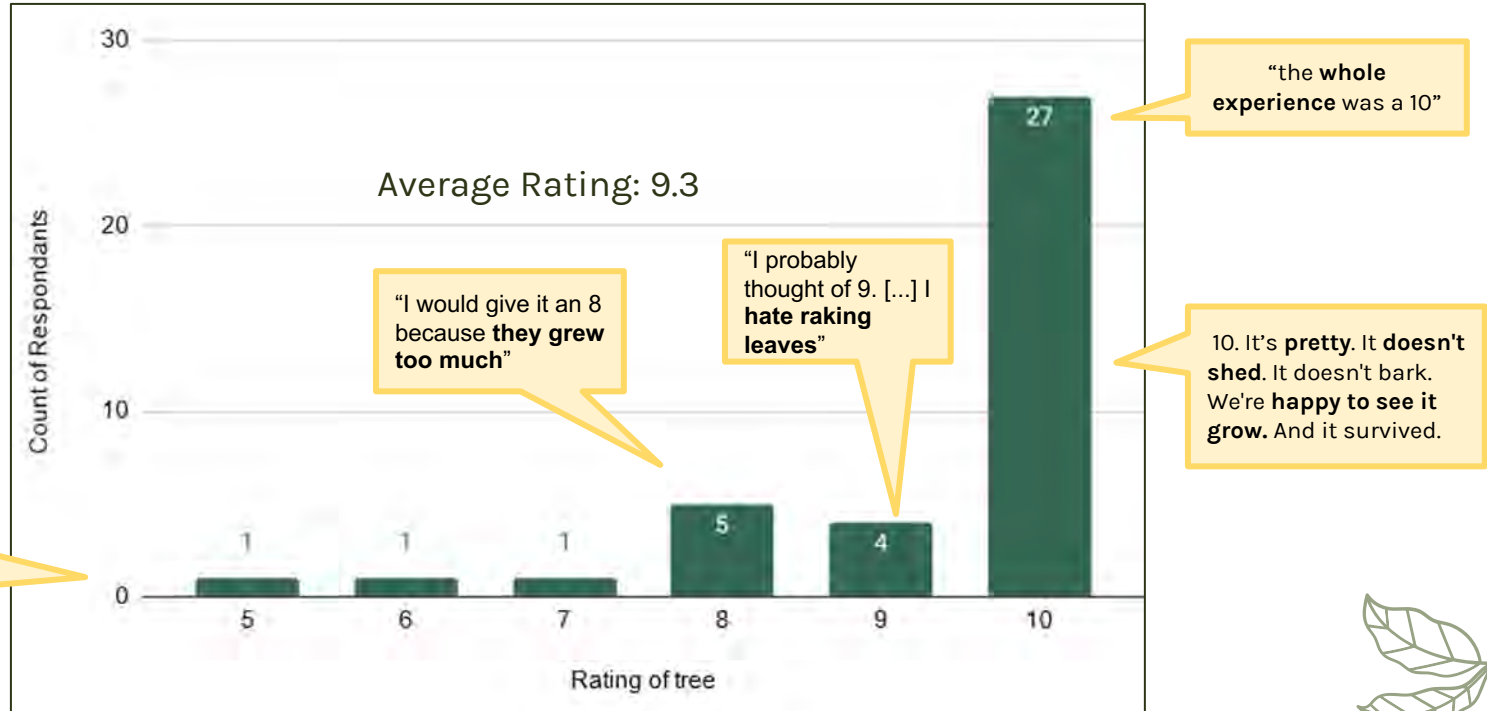
## Chelsea

- In 2024, trees in our sample contributed over **\$6,226** worth of ecosystem services.
- Trees Sequester **2.4 tons** of carbon annually.
- Trees remove **12 pounds** of pollution from the air annually
- Trees produce **6.3 tons** of Oxygen annually



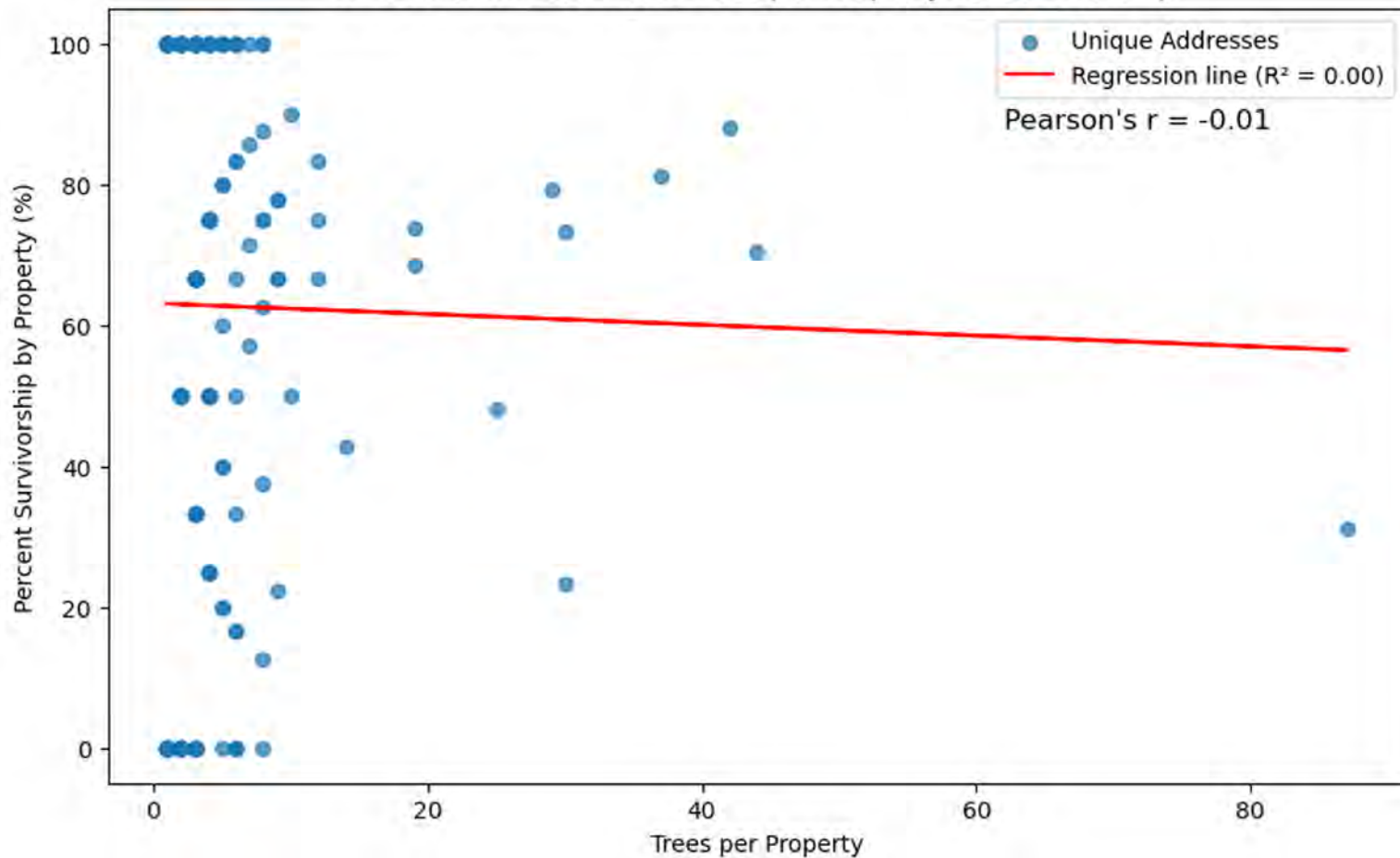
# Resident experience with GGCP Trees

Q: How would you rate your overall experience with your [GGCP] tree(s) from 1-10?

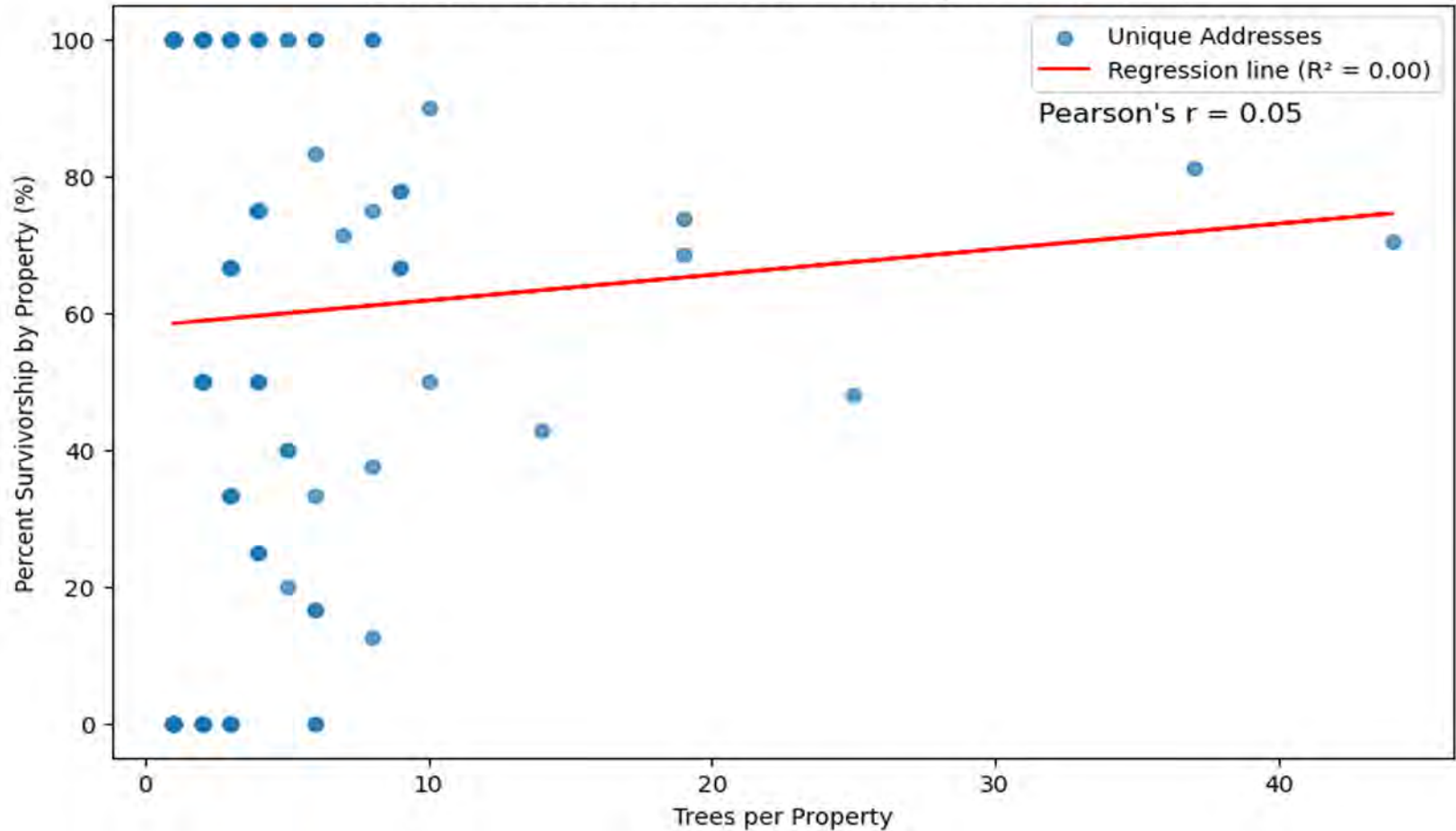




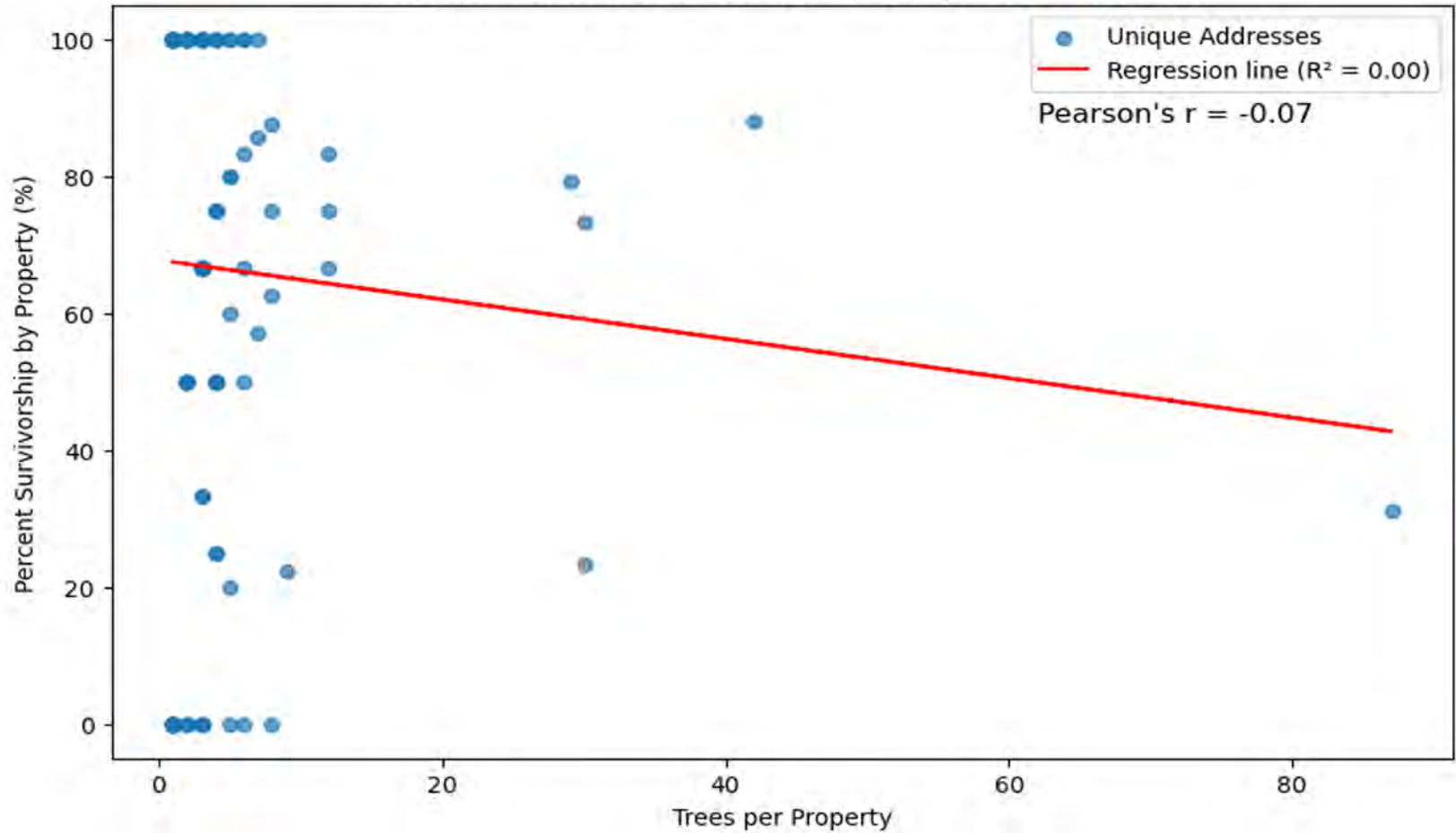
All Overall Private Trees: Trees per Property vs. Survivorship



Chelsea Private Trees: Trees per Property vs. Survivorship



Holyoke Private Trees: Trees per Property vs. Survivorship



Holyoke Private Trees without 100 Bigelow: Trees per Property vs. Survivorship

